TMP 122 New Venture Business Plan
NaviCane

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1 Executive Summary

NaviCane is a next-generation smart mobility aid designed to empower visually impaired individuals with greater independence, safety, and confidence. Traditional tools like white canes and guide dogs each come with critical limitations; canes offer only tactile ground-level feedback, while guide dogs are prohibitively expensive and impractical for many. NaviCane bridges this gap with an intuitive, AI-powered smart cane that delivers multi-level obstacle detection, real-time indoor and outdoor navigation, and environmental awareness through audio and haptic feedback, all within a familiar form factor: the cane.

Targeting a growing market of over 285 million visually impaired individuals globally, NaviCane enters at a time when demand for assistive technologies is accelerating, with the global market projected to exceed $40 billion by 2030. By integrating LiDAR, ultrasonic sensors, visual SLAM, and AI-based object recognition into a single cane, NaviCane uniquely combines accessibility, affordability, and advanced functionality, differentiating itself from existing solutions like WeWALK and Sunu Band.

2 Problem Summary

The modes of getting around for the blind primarily include canes or guide dogs. Canes have an average length of 4 feet and require the user to stay vigilant in all directions during travel. Professor Amit Ahuja, a Political Science professor at UCSB, spoke about his experience with using a cane on campus on the podcast "Central Bark". He mentioned that at first he believed that he could navigate through campus with a cane, but soon realized that the campus was filled with students on bikes, skateboards, and scooters. On such a busy campus, walking with a cane alone proved inefficient, and Professor Ahuja had to make modifications.

Alternatively, Professor Ahuja chose to adopt a guide dog to help him navigate campus. He talks about how, although he was hesitant at first, he's come to adore his dog and has become accustomed to owning one. While it was a success for Professor Ahuja, guide dogs can be a hassle. To breed, raise, train, and nurture one guide dog can cost about $50000 on average, throughout their lifetime. Also, owning a dog may be inconvenient to the user, whether it's allergies or the attention dogs require (especially physically). Not everyone can accommodate a dog into their life.

https://www.guidedogs.com/podcasts/amit-ahuja

According to the NIH, about 1 in 9 people aged 60 or above are blind or have MSVI (moderate or severe visual impairment), by age 80, it is 1 in 3. Visual impairment is described as the leading reason for the loss of independence among the elderly. With the rising population, as the current population ages, we expect to see a rapid increase in visual impairment.

https://pmc.ncbi.nlm.nih.gov/articles/PMC5820628/#:~:text=By%20age%2060%2C%20around%201,are%20blind%20or%20have%20MSVI.

As maintained by an employee of the Braille Institute of Santa Barbara, navigation canes are the most common and preferred mode of transportation amongst the visually impaired today. That being said, the cane has several issues. One, since the risk of visual impairment increases with age, many navigating with canes are also battling arthritis issues and they struggle to move the cane around. Additionally, the cane easily gets stuck in dangerous areas (such as car wheels). It can, therefore, fail to detect or be too late to detect the obstacles that could keep someone safe.

> First we spoke to the Braille Institute of Santa Barbara. They let us know that canes are convenient, cheap and easily adaptable. So, while our original design included one with the vest, after this interview, we began thinking about shifting towards the idea of reconstructing a cane rather than the vest.

Furthermore, we spoke to some Mechanical Engineering students at UCSB, who further suggested that a cane would be a better and easier design to technologically integrate from the engineering perspective.

Finally, we spoke to Professor Amit Ahuja, who had used a cane around UCSB, as a blind professor. He had to make a switch from cane to guide dog, because of difficulty navigating a busy campus.

From the insight we received from personal experiences, people who work with the visually impaired and engineering students, we felt we had well rounded knowledge into what went into designing a good cane for the visually impaired.

Ideally, we want to target this design for those who live in urban, high-traffic environments. These individuals face the most difficulties with navigation, especially the elderly. Because traditional canes provide limited feedback, it can lead to dangerous situations and challenges, and while guide dogs are a good alternative, they can be expensive and impractical for some lifestyles.

We want to improve the quality of daily lives of our customers, in terms of safety, independence, and confidence in their mobility. NaviCane seeks to do so by enhancing the current design for a mobility cane, which is something users are comfortable with and prefer, with smart technology offering detection, navigation, and feedback. This keeps the design familiar and yet a more powerful mobility aid.

3 Product Overview

Our alternative solution to the traditional walking cane and guide dog is the NaviCane– a cane fitted with LiDAR to detect obstacles and their distances from the user. The cane is equipped with vibration motors embedded around the handle. As the user approaches an obstacle, the motors vibrate to inform them of the approaching hazard. The side corresponding to the location of the obstacle will vibrate.

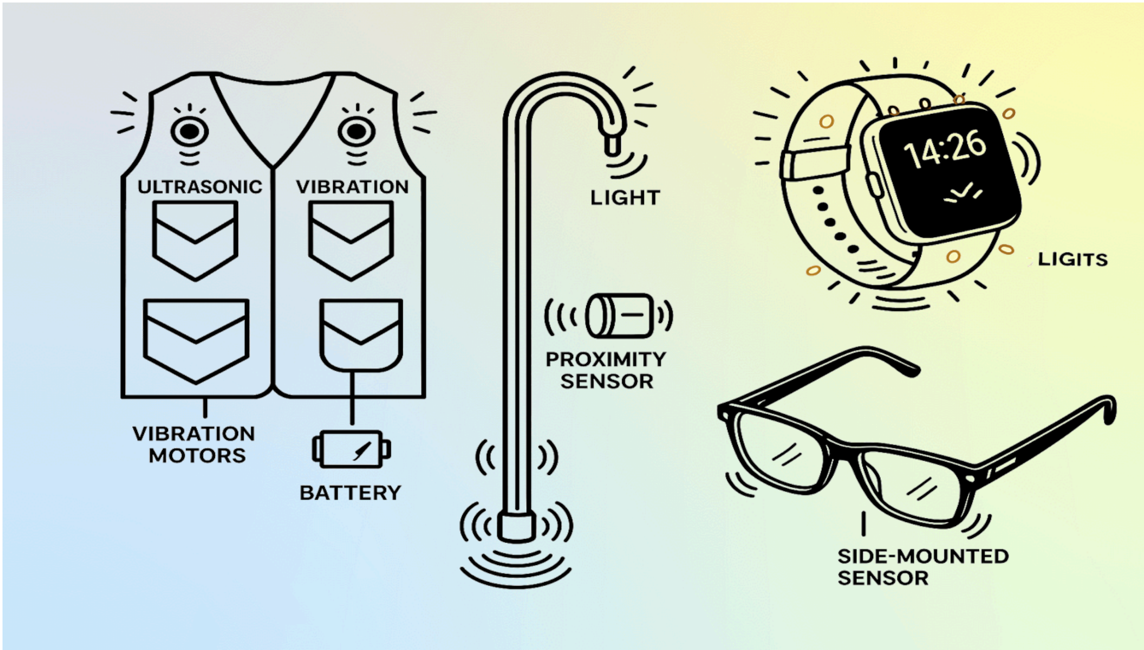
Originally, we approached the solution with a vest using the same technology. However, after reflecting and consulting with a team of Mechanical Engineers, we realized that a vest may not be the most robust solution. The cane emerged as a better alternative for several reasons: first, adaptability. Users are already familiar with a walking cane, and rather than learning a new apparatus and new sensors, they would only need to familiarize themselves with the cane's vibration feedback.

Second, the cane is easier to engineer and manufacture. Since our goal is to produce a cheaper, more convenient solution, this is an important consideration. It allows us to make the product more accessible to the regular user.

Third, the cane is generally easier to maintain and store, which contributes to greater customer satisfaction.

While considering different designs, we also explored other alternatives, including glasses and a watch. Glasses could have been a viable alternative; however, too costly. As one of our principal goals is to minimize costs, this eliminates the option.

A watch was another practical solution; however, this would shift our focus toward software development. As we also aimed to keep a simple design, for easier adaptability, we chose to not pursue this option. This also accelerates us into software territory, with strong competition, where we lack the experience to effectively compete.



After showing our prototypes and receiving feedback from initial users, we gained valuable insights into the user experience and adjusted our design accordingly to improve intuitiveness and accessibility. We started with glasses, a watch feature, a cane, and a vest. After showing our prototype designs to potential customers, we learned that a cane was preferred. From a manufacturing and engineering standpoint, we also learned that the cane would be the most suitable product to create.

To continue refining NaviCane, we engaged in additional design thinking iterations based on feedback from our initial prototype testing. We developed more detailed mockups of the cane and began working on the layout of the internal electronics and haptic feedback system. These updated designs were shared with more potential users, including individuals from the Braille Institute of Santa Barbara, to gather deeper insights.

From these MVP tests, we confirmed that the cane form factor was preferred and that the haptic feedback was well-received. However, a key takeaway from our interviews was the importance of keeping the electronics as simple and non-bulky as possible. Users emphasized that a mobility aid should feel natural and familiar, so any added technology must not interfere with usability, comfort, or the lightweight nature of a traditional cane. This feedback pushed us to prioritize a minimalistic, intuitive design that still maintains high-quality functionality.

We also explored alternative technologies:

- Sensor Selection: Compared LiDAR and ultrasonic sensors, ultimately opting for a hybrid approach to ensure both accuracy and affordability.
- AI Capabilities: Continued refining our object detection system to ensure meaningful real-time feedback.
- Indoor Navigation: Evaluated vSLAM for indoor guidance, confirming its technical feasibility within a compact form.

4 Value Proposition

For tech-savvy people with visual impairments who need safe, confident travel, NaviCane is a smart cane that delivers AI-powered, multi-level obstacle sensing plus indoor/outdoor navigation in a familiar form—unlike white canes or standalone apps, it fuses advanced sensors and AI so you can move freely and fearlessly anywhere.

Leveraging the insights gained from understanding user challenges and evaluating the technological possibilities, the value proposition for NaviCane is clear. Technologically adept, visually impaired individuals are seeking greater safety, confidence, and independence in their mobility. Current strategies and tools frequently encounter limitations with traditional mobility aids, facing risks from undetected obstacles (especially at head-level), challenges navigating complex or unfamiliar indoor and outdoor environments, and difficulty accessing real-time information about their surroundings.

NaviCane is a technology-enhanced Smart Cane that provides comprehensive environmental sensing (multi-level obstacle detection, AI-powered object and text recognition) and integrated seamless indoor/outdoor navigation guidance delivered through intuitive, non-visual (audio and haptic) feedback. Unlike traditional white canes (which offer only ground-level tactile feedback) and basic electronic travel aids or navigation apps (which lack integrated multi-level sensing, AI capabilities, or indoor navigation). Our product uniquely combines advanced sensor fusion, artificial intelligence for real-time environmental understanding, and robust indoor/outdoor navigation within a familiar cane form factor, empowering users with significantly enhanced perception, safety, confidence, and freedom of movement in virtually any environment.

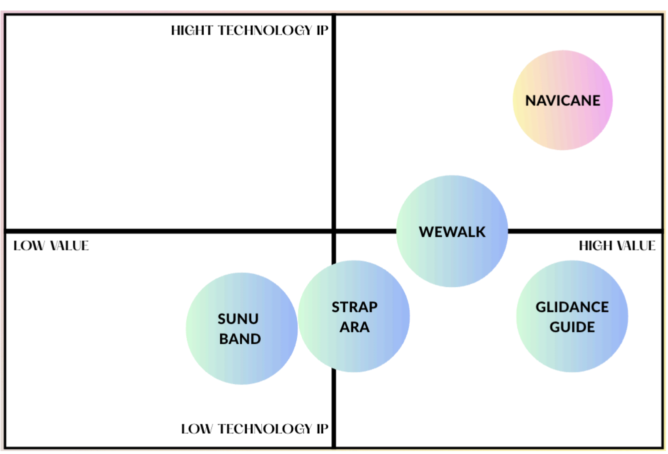
This value highlights not just the functional capabilities of NaviCane, such as detecting obstacles or providing directions, but emphasizes the ultimate benefits for the user: a tangible increase in safety, a boost in confidence when navigating, greater independence in daily travel, and the resulting ability to participate more fully in work, education, and social life It addresses the holistic nature of the mobility challenge faced by the visually impaired community.

5 Competitive Analysis

Feature	NaviCane (Projected)	WeWALK Smart Cane 2	Glidance Glide	Strap Ara	Sunu Band	Traditional White Cane
Form Factor	Cane	Cane	Wheeled Robotic Guide	Chest-worn Wearable	Wrist-worn Wearable	Cane
Ground Obstacle Detect	Yes (Multi-sensor)	Yes (Cane Tip)	Yes (Sensors)	Yes (Ultrasonic/ LiDAR)	Yes (Ultrasonic)	Yes (Cane Tip)
Head-Level Detect	Yes (Ultrasonic/LiDAR)	Yes (Ultrasonic)	Yes (Sensors)	Yes (Ultrasonic/ LiDAR)	Limited/No	No
Drop-Off Detection	Yes (IR/LiDAR)	Limited/No	Yes (Sensors)	Yes (LiDAR/Ultrasonic)	Limited/No	Limited (Cane Tip)
Outdoor Navigation	Yes (High-Precision GPS + App)	Yes (Via Paired App)	Yes (AI/Sensors)	Basic Orientation	Basic (Via App)	No
Indoor Navigation	Yes (vSLAM/VPS + App)	Limited (App-based/WeASSIST)	Yes (AI/Sensors)	No	No	No
Object Recognition	Yes (Camera	No	Yes (Scene Description	Limited (Object vs.	No	No

(AI)	+ AI)		)	Person)		
Text Recognition (AI)	Yes (Camera + AI)	No	No	No	No	No
Feedback Type	Haptic + Audio (Spatial/ Speech)	Vibration + Audio (App)	Haptic + Audio	Haptic	Haptic	Tactile (Cane Tip)
Connectivity	Bluetooth + App	Bluetooth + App	Yes (Details Unspecified)	Wi-Fi (Updates)	Bluetooth + App	N/A
Pricing (Approx. USD)	TBD (Targeting Mid-High Tier)	$850 - $1,150	$1,199 + $30/month subscription	$1,700	$299	$20 - $60
Business Model	TBD (Likely Hardware Sale + Optional Subscription)	Hardware Sale + Optional Subs.	Hardware Sale + Req. Subscription	Hardware Sale	Hardware Sale	Hardware Sale

Competitor Name	URL	Product Line	Key Features	Market Share (U.S).
WeWalk	https://wewalk.io/en/	Smart Cane, WeAssist	voice assist, navigation instruction, Bluetooth	N/A
Glidance Glide	https://glidance.io/	Glide	Directional haptic feedback, speaker/microphone, and automatic steering	N/A
Strap Ara	N/A	Ara Band	LiDAR detection, multiple-level detection	N/A
Sunu Band	https://www.aph.org/product/sunu-band/	Sunu Band	Radar & Haptic Feedback	N/A
Traditional Cane	https://carroll.org/product-category/canes/	Walking cane, Multiple Cane tips	Adjustable height, changeable tip options	10%-15%



Feature	NaviCane Projected	WeWALK Smart Cane 2	Glidance Glide	Strap Ara	Sunu Band	Traditional White Cane
Head-Level Detect	X	X	X	X		
Drop-Off Detection	X		X	X		
Outdoor Navigation	X	X	X		X	
Indoor Navigation	X		X			
Object Recognition (AI)	X		X			

Our competitive moat is built on three interlocking pillars that create sustainable barriers to entry and position NaviCane for rapid growth:

1. **Cost Leadership via Low-Cost Sensor Platforms:**
    - **Commodity Sensor Sourcing & Economies of Scale:** Utilizes readily available, mass-produced components (sub-$5 ultrasonic, sub-$50 LiDAR, off-the-shelf IMUs) and volume ordering to achieve industry-low Bill of Materials (BOM) costs.
    - **Modular Hardware Architecture:** Standardized internal connectors allow quick, low-cost sensor swaps and upgrades, ensuring production costs fall with sensor prices.
    - **Lean Manufacturing Partnerships:** Leverages existing white-cane manufacturing lines for rapid, low-capex scale-up, avoiding bespoke production inefficiencies.
2. **Proprietary Integration & AI-Driven Differentiation:**
    - **Sensor Fusion Algorithms:** In-house Kalman-filter + CNN pipeline fuses sensor data at sub-20ms latency for consistent multi-level obstacle detection, protected as a trade secret.
    - **Adaptive Haptic-Audio Feedback Engine:** Dynamically modulates vibration and audio cues based on obstacle velocity, trajectory, and user gait, offering nuanced alerts beyond simple warnings for a superior user experience.
    - **Continuous Over-The-Air (OTA) Model Updates:** Anonymized data collection refines object-recognition networks quarterly, ensuring the system continuously improves, unlike static legacy solutions.
3. **Cross-Industry Scalability & Healthcare Innovation:**
    - **Platform Multiplicity:** Core sensor-fusion and feedback tech can be repackaged for other devices (fall detectors, wheelchair warnings, hospital wayfinding), opening multiple licensing avenues beyond canes.
    - **Healthcare Use Cases & Reimbursement Pathways:** Pursuing FDA 510(k) clearance for variants (e.g., walker-safety) enables access to Medicare/Medicaid reimbursement, creating a clinical moat.
    - **Data-Driven Remote Patient Monitoring (RPM):** Anonymized metadata streaming enables subscription-based RPM services, alerting caregivers to changes in user mobility patterns and creating a recurring revenue stream with deep clinical integration.

These pillars are further strengthened by network effects & strategic partnerships, including endorsements from major vision-care non-profits (driving adoption and reimbursement) and a growing developer ecosystem (creating switching costs).

Together, these elements ensure NaviCane remains cost-effective, highly differentiated, and defensible against competitors, particularly in the high-barrier healthcare sector.

6 Market Summary

The market size for assistive technology for the visually impaired is sizeable and rapidly growing due to global aging trends and increasing accessibility investments.

- 285 million people globally live with some form of visual impairment
- 39 million are blind
- About 70% of childhood blindness worldwide is caused by conditions present at birth (congenital causes) or shortly after birth.
- In the US alone, over 7 million adults report a visual disability

World Health Organization. (2014). *Visual impairment and blindness*. World Health Organization. https://www.who.int/news-room/fact-sheets/detail/blindness-and-visual-impairment

Prevalence of blindness increases sharply with age:

- 1 in 9 people aged 60+ are blind or have moderate to severe visual impairment
- By age 80, 1 in 3 are affected

National Federation of the Blind. (2022). *Statistical facts about blindness in the United States*. https://nfb.org/resources/blindness-statistics

Varma, R., Vajaranant, T. S., Burkemper, B., Wu, S., Torres, M., Hsu, C., Choudhury, F., & McKean-Cowdin, R. (2016). *Visual impairment and blindness in adults in the United States: Demographic and geographic variations from 2015 to 2050*. *JAMA Ophthalmology, 134*(7), 802–809. https://pmc.ncbi.nlm.nih.gov/articles/PMC5820628/

Market Growth:

- The global assistive technology market was valued at approximately $22 billion in 2022 and is projected to grow at a CAGR of 7-9%, reaching $40 billion by 2030. This growing market indicated a strong demand for innovative technology-enhanced mobility solutions.
- CAGR = $(40/22)^{1/8} - 1 = 0.079$

Allied Market Research. (2023). *Assistive technology market by type and end user: Global opportunity analysis and industry forecast, 2023–2030*. Allied Market Research. https://www.alliedmarketresearch.com/assistive-technology-market-A06639

TAM: The global market for mobility devices for the visually impaired

- 285M visually impaired x 10% adoption x $1,200 unit price = $34.2 billion

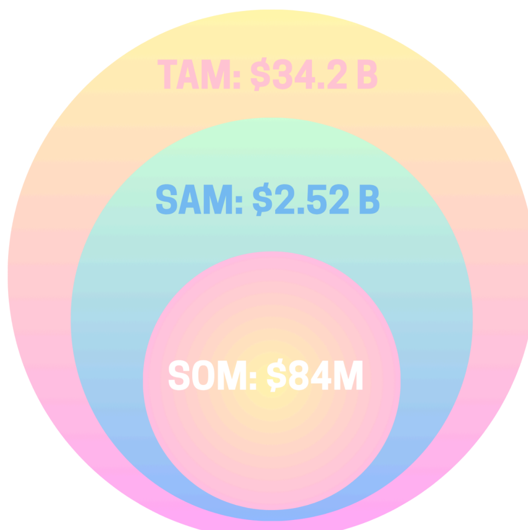
- Assumes 10% of the global visually impaired population would realistically be in the market for an advanced navigation cane at $1,200.

SAM: The US market for visually impaired individuals willing to adopt new technology

- 7M US visually impaired x 30% adoption x $1,200 price = $2.52 billion
- Focused on the U.S. population, where insurance support, disability aid programs, and technology adoption are more favorable.

SOM: Realistic first-year goal: 1% of the US visually impaired population

- 70,000 users x 1,200 price = $84 million
- An initial target of capturing 1% of the U.S. visually impaired market, yielding 70,000 customers.



- The beachhead market for our product will mainly be blind and visually impaired individuals. They are the ones who will benefit most from a solution that helps them move around safely. Furthermore, the vest will help by detecting obstacles and any hazards.
- An estimated 7 million Americans are blind or visually impaired (source: National Eye Institute, NIH).
- Family members/caregivers of the visually impaired could be a part of our beachhead, too. They are often looking for ways to help their loved ones when it comes to safety.
- We can also target organizations that focus on specific tech for visually impaired individuals. They are already involved in finding new ways to improve accessibility for these individuals.

- With that, to reach this market, we can partner with organizations that support blind and visually impaired individuals to help spread the word.
- Partnering with schools and programs for the blind would also allow us to introduce the vest to people who are learning how to navigate on their own. For example, we are connecting with the Braille Institute of SB.
- We can use online marketing to help connect with people who are looking for new technologies (like ours). This approach will help us build a strong foundation with our initial market, making it easier to expand to a wider audience down the line.

https://www.nei.nih.gov/learn-about-eye-health/eye-health-data-and-statistics

7 Implementation

For a successful product implementation, we need several factors to succeed.

Product Development

Our initial goal is to create a prototype that can be tested with a wide variety of users, from which we can gather data and iterate on our design. Within this phase of development, we hope to work with individuals or partner with local organizations, such as the Braille Institute of Santa Barbara. These smaller groups will inform us about any problems with our product, user confusion, and aid any refinements.

Once we establish a functional and user friendly prototype, we enter the beta-testing phase of our production. Here, we plan to partner with the National Federation of the Blind to distribute the prototypes amongst a broader range of users. Their feedback will give us a broader understanding of our prototype and what needs to be improved for any final adjustments.

Manufacturing

NaviCane values accessible, easy and affordable products. Hence, we will focus on a manufacturing strategy that minimizes cost while maximizing scalability.

We plan to partner with white-cane manufacturers because we wish to augment the traditional cane design, rather than create entirely new products. This reduces our production costs while keeping the cane design our users are familiar with. For electronic components, we hope to buy quality electronics in bulk to reduce the price of manufacturing.

Partnerships

Partnerships are vital to the success of NaviCane, in terms of developing, testing, distribution and finally adoption. We are currently organizing meetings with the Braille Institute Santa Barbara Center. We hope an early partnership with them will allow us to build early partnerships for user testing and feedback. This will allow for early iterations of our design.

We intend to collaborate with the National Federation of the Blind, for large beta testing, endorsements and building a national network for our product. Their support is crucial for the success of our company.

Funding

To make Navicane viable and accessible to the public, we need a combination of federal subsidies and insurance programs.

1. HSA/FSA Approval
    a. Many medical products and services are eligible for reimbursements through these programs. Because NaviCane caters to those with legitimate needs, there is a strong possibility that we are able to get approval for these programs. If so, we are able to expand our product and make NaviCane more accessible to a larger market.
2. ADA and Insurances
    a. Although ADA recommendations do not certify medical products, being on the ADA recommended lists boosts the credibility of our products. We additionally want to work with advocacy groups to make our product more affordable. Many insurance providers cover medical devices, and we wish to work towards insurance coverage for Navicane
3. Small Business Innovative Research and Small Business Technology Transfer Research
    a. NaviCane seeks SBIR and STTR grants through NIH (specifically the NEI). Phase I provides feasibility of the concept and determines the overall potential of the product. It provides up to $296,000. Phase II is the R&D stage, which provides about $1.97 million. It advances the product, reaching commercialization. Phase III is commercialization, and no funding is provided during this phase of the grant.

https://www.nei.nih.gov/grants-and-training/funding-opportunities/programs-and-research-priorities/small-business

8 Financial Analysis

After reviewing potential business models, including subscription services and hardware leasing, we've selected a ***direct hardware sales model, with optional app subscription services*** *for extended functionality (e.g., advanced custom voice commands, premium navigation updates, specialized map layers). This hybrid model is projected to ensure robust early-stage revenue through hardware sales, simplify user adoption, and align with common pricing structures in the assistive technology market. The optional subscription provides a pathway for generating recurring revenue and enhancing lifetime value per customer.*

Estimated Startup Costs *The initial investment required to bring NaviCane to market is estimated as follows. It's important to note that R&D and Software Development figures are initial estimates for achieving a market-ready prototype and first version; further investment may be beneficial for accelerated development or expanded features beyond the current scope..*

- ***R&D and Prototyping:*** *$45,000 Justification: Covers initial design, component selection, iterative development of functional prototypes, and early-stage sensor testing, leveraging academic research and open-source components where feasible.*
- ***Hardware Components (Initial Sourcing):*** *$95,000 Justification: Budgeted for acquiring specialized sensors (LiDAR, ultrasonic), microcontrollers, battery systems, and materials for multiple iterative hardware prototypes and a small pilot production run.*
- ***Software Development:*** *$135,000 Justification: Allocated for a lean development team to create firmware, core sensor fusion algorithms, basic AI modules (leveraging existing frameworks for object/text recognition), foundational navigation logic, and the initial version of the companion mobile app.*
- ***Manufacturing Setup (Initial Production Runs):*** *$200,000 - $500,000 Justification: Includes costs for tooling, molds, initial engagement and setup with contract manufacturers, and establishing quality control protocols for early-stage production volumes. The range reflects varying complexities and scales of initial runs.*
- ***Compliance & Certification:*** *$30,000 Justification: Earmarked for essential regulatory certifications required for electronic and assistive devices (e.g., FCC, CE, RoHS), ensuring product safety and market access.*
- ***Integration & User Feedback Iterations:*** *$45,000 Justification: Covers costs associated with structured usability testing with visually impaired individuals and O&M specialists across multiple prototype iterations, including participant recruitment, testing logistics, and data analysis for design refinement.*

- ***Overhead (Legal, IP, Initial Admin):*** *$15,000 Justification: Allocated for company incorporation, initial legal consultations, provisional patent filings to protect core IP, essential contract templates, and basic administrative setup.*
- ***Total Estimated Startup Costs: ~$565,000 - $865,000*** *(Midpoint: $715,000)*

Unit Economics

- ***Target Retail Price (MSRP):*** *$400 per unit*
- ***Estimated Cost per Unit (COGS):*** *$250 (Includes components, manufacturing, assembly, basic packaging. Subject to refinement with volume)*
- ***Contribution Margin per Unit:*** *$150 ($400 - $250)*
- ***Gross Margin Percentage:*** *37.5%*

Revenue and Break-Even Analysis

- **Competitive Positioning:** To be competitive and accessible within the assistive technology market, NaviCane is strategically priced at $400. This is significantly lower than many existing smart canes with fewer features, offering substantial value.
- **Revenue per Unit (Direct Sales):** $400
- **Break-Even Point (on initial startup costs):**
  - Fixed Startup Costs to Recoup (using midpoint estimate): $715,000
  - Gross Margin per Unit: $150
  - **Break-Even Units = $715,000 / $150 = ~4,767 units**

Profitability Timeline (Projections)

- **First Year Sales Target:** 2,500 units (representing a moderate market entry)
- **Annual New Customer Growth (Year 2 onwards):** Projected at 10% YoY
- **Year 1 Financials:**
  - Hardware Revenue: 2,500 units × $400/unit = $1,000,000
  - Cost of Goods Sold (Hardware Costs): 2,500 units × $250/unit = $625,000
  - Gross Profit from Hardware: $375,000
  - Operational Costs (Marketing, Sales, Admin, Ongoing Support): A significant portion of initial operational costs are anticipated to be subsidized by grants (e.g., SBIR/STTR Phase II operational allowances) or covered by seed funding. For this projection, we assume grant funding covers a substantial part of these initial operational expenses.
  - **Net Income Year 1 (before tax, assuming operational cost subsidies):** Approximately $375,000 (from gross profit).

- **Recouping Initial Investment:**
  - With a Year 1 net contribution of $375,000 towards recouping startup costs, $340,000 ($715,000 - $375,000) would remain.
  - Projected Year 2 sales (2,750 units at 10% growth) would generate a gross profit of $412,500 (2,750 units * $150).
  - Therefore, the initial startup investment of ~$715,000 is projected to be **recouped during Year 2 of operations.**

Growth Assumptions

- *Steady 10% customer acquisition growth year-over-year after market establishment.*
- *Future implementation of optional app subscriptions (e.g., $5-$10/month for premium features) is projected to increase the lifetime value (LTV) per user and provide a recurring revenue stream.*
- *Successful attainment of HSA/FSA eligibility, insurance reimbursement pathways, and partnerships with organizations like the ADA will further expand the addressable market and user accessibility.*

Funding Strategy

- ***Initial Seed Funding:*** *Primarily targeting* ***SBIR/STTR grants*** *from institutions like the National Institutes of Health (NIH), particularly the National Eye Institute (NEI), which support innovative assistive technologies. Phase I grants will fund final R&D and feasibility, while Phase II grants will support full-scale development, initial manufacturing, and commercialization efforts.*
- ***Series A (Post-Grant/Early Commercialization):*** *Seek strategic investment from venture capital firms and angel investors specializing in med-tech, assistive technology, aging population solutions, or social impact ventures.*
- ***Other Support:*** *Actively pursue* ***HSA/FSA eligibility*** *for NaviCane. Collaborate with advocacy groups and work towards* ***insurance coverage*** *to enhance affordability. Explore partnerships with non-profit organizations for co-funding or distribution initiatives.*

Exit Strategy *We foresee the following potential exit pathways for investors and founders within a 5-7 year timeframe:*

1. ***Acquisition:*** *By a larger medical technology company, a major consumer electronics firm expanding into health and accessibility (e.g., Apple, Google), or a specialized assistive technology leader (e.g., Medtronic, Sonova indirectly).*

2. ***Licensing of Technology:*** *Key IP developed for NaviCane (e.g., advanced sensor fusion algorithms, AI-driven navigation for the visually impaired, vSLAM implementations) could be licensed to other mobility aid manufacturers or technology companies.*
3. ***Growth-to-IPO:*** *While a longer-term and less common path for specialized assistive tech, achieving significant market share and demonstrating strong growth with a diversified product suite could make an Initial Public Offering a viable option.*

9 The Team

*Hi, my name is **Neha Nepal,** and I am a Mechanical Engineering major at UCSB. I have a strong foundation in product design, prototyping, and engineering analysis. I have experience with several CAD tools such as Solidworks, Finite Element Analysis for product evaluation, and 3D printing for rapid prototyping. My engineering background has given me a strong foundation in the design cycle, taking concepts to design and testing. It also gives me strong problem-solving skills and the ability to think and adapt quickly, skills I can bring to the NaviCane team.*

*Hello, my name is **Nikhil Kapasi** and I am a Computer Engineering student at UCSB. Throughout my time here as a student, I have contributed to various projects (research, internship, clubs or otherwise). I have extensive experience working in groups, both as a leader and an individual, expertise I am excited to bring to our NaviCane team. Engineering provides me with a unique perspective of how to think and react in different situations.*

*Hi! My name is **Soniya Patel**, and I'm an Economics and Accounting major at UCSB. With internship experience at leading financial consulting firms, I bring a business-oriented perspective to the NaviCane team. My background includes financial modeling, strategic analysis, and client-focused problem-solving. I'm passionate about leveraging innovative thinking to tackle real-world challenges, especially those that promote accessibility and social impact. With a strong foundation in both data and communication, I help bridge the gap between technical design and market viability to ensure NaviCane's long-term success.*

*My name is **Kevin Lucio** and I am an Economics and Accounting major at the University of California Santa Barbara. Currently I am in my third year and have experience in team management, building client relationships and sales. I believe in creating a welcoming environment that promotes innovation and fosters growth, and I am willing to put in the work to help the team achieve its goals.*

*Hi! My name is **Desiree Garcia**, and I'm a double major in Data Science & Statistics and Communications at UCSB. My background bridges both analytical thinking and creative communication. I bring experience in customer relations, sales forecasting, and team leadership from my roles in retail and hospitality. I'm especially passionate about making data-driven decisions that center real user needs and amplify accessibility. For NaviCane, I focused on gathering user insights, communicating findings, and ensuring our product stayed rooted in empathy and usability.*

*Hi my name is **Haley Spence**, and I am a Communications major at UCSB. I believe in doing the right thing always as that was how my parents raised me. Even when no one's watching, and I'm committed to providing real value to every person in my life. In any job that I work, I* *go above and beyond to make sure that every expert's expectations are exceeded. I love communicating and trying to better each and every person's life.*

10 Appendix

10.1 Problem Research Plan

For our project, we wanted to interview a wide variety of individuals who could provide different perspectives for different aspects of the project. First, we set up an interview with an employee from the Braille Institute of Santa Barbara. From her, we wanted to know how someone who works and takes care of the blind feels the key improvements needed for the cane.

Secondly, we spoke to a group of Mechanical Engineering students. The goal was to determine the feasibility of the vest, with the electronics we had intended to use. From them, we were able to gather a couple of other ideas for better prototypes and better engineering products.

Thirdly, we set up an interview with a blind professor of Political Science at UCSB. Our goal in speaking with him was to gain the perspective of a blind person navigating a busy campus. He had also made the switch from cane to guide dog, and we wanted further insight on what pushed him to switch modes of transportation.

Because our project included a distinct subset of people, we were only able to gather a few interviews. We attempted to increase the number of individuals we interviewed by interviewing a couple of students for Mechanical Engineering, but we were unable to interview 12 people.

Interview Questions for Braille Institute Spokesperson:

- *How do you work with the blind on the day-to-day?*
- *What have you observed as being the biggest challenge when navigating?*
- *What is the most common/preferred mode of transportation today?*
- *If you could fix one thing in the method of transportation, what would it be?*
- *What are some things you teach in intro classes for the blind?*

Interview Questions for the Professor:

- *Can you describe a typical day navigating UCSB blind?*
- *What are the differences between navigating with a guide dog versus a cane?*
- *What were the biggest challenges navigating with a cane?*
- *What are the benefits and challenges of navigating with a cane?*
- *Is it easier to navigate elsewhere with a cane versus UCSB?*

Interview Questions for Mechanical Engineers:

- *Do you think the electronics and sensors can be realistically integrated into a wearable vest?*
- *What challenges do you foresee in implementing real-time obstacle detection and user feedback?*
- *What kind of sensors or technologies would you recommend for this application)?*
- *What are some common pitfalls in prototyping wearable electronics?*
- *What would you suggest to make the product more durable and user-friendly?*

10.2 Problem Research Results

05/06/25, Neha Nepal & Leanne (Braille Institute)

- "I would say canes are the most preferred method amongst everyone I work with."
- "I wish everyone could put on a mask and try to navigate with [a] walking stick."
- People designing don't know how to cater to the blind. They are seeing and cannot capture that perspective correctly.

05/13/25 Neha Nepal & Mechanical Engineering Students (Arjun Gunda, Alec Perkins, Amanda Katz)

- Putting hardware in a vest is undesirable and may be difficult
- Easier to integrate into a cane, more built for sensors overall
- "As a control theorist, I find that keeping up with the feedback loop will be difficult as video processing and image processing will be expensive."

04/28/25 Neha Nepal & Amit Ahuja

- Cane is difficult to Navigate with on UCSB campus.
- Guide dog was a good accomodation in my life
- It was a tough decision, trying to figure out whether she would truly fit into my schedule

Throughout our interviews, we found that a cane is the overall most popular choice amongst interviewees. Therefore, the decision to switch from vest to cane was an obvious choice and we were grateful for our interviewees that informed the decision.

10.3 Solution Testing Plan

In the initial phase of product development for NaviCane, the team undertook an exploratory research process to identify the most promising solution for an advanced mobility aid. This involved the creation and evaluation of four distinct low-fidelity prototypes, representing different form factors and technological approaches:

- Smart Glasses: This concept envisioned eyewear integrated with forward-facing sensors and audio feedback (e.g., bone conduction) to provide heads-up environmental information and alerts.
- Smart Watch Feature: This prototype explored a smartwatch interface designed to pair with external sensors, delivering haptic and audio navigation cues to the user's wrist.
- Sensor Vest: An early leading concept, this prototype involved a lightweight vest embedded with multiple sensors (e.g., LiDAR, ultrasonic) at various heights to offer comprehensive, multi-level obstacle detection, with feedback primarily delivered haptically.
- Enhanced Cane: This concept focused on augmenting the traditional white cane with basic sensor modules near the tip and a vibrating handle for tactile feedback.

To evaluate these initial concepts, the team engaged in a series of discussions and feedback sessions (as detailed in Checkpoint #1 and further informed by research in the "Problem Summary"). This involved presenting the low-fidelity prototypes (concept sketches and basic digital mock-ups) to potential users, individuals familiar with the needs of the visually impaired community, and technical experts.

Strong User Preference for Cane Form Factor: Overwhelmingly, feedback from potential users indicated a strong preference for the Enhanced Cane concept. The primary driver for this preference was the familiarity and existing user comfort with traditional canes. Augmenting a known and trusted tool was perceived as having a significantly lower barrier to adoption compared to entirely new wearable technologies like glasses or a vest. The smartwatch was generally viewed as a potential accessory for notifications rather than a core system for primary mobility sensing.

Expert Endorsement of Cane Feasibility:

- Consultations with staff at the Braille Institute of Santa Barbara reinforced this user preference, highlighting that canes are valued for being "convenient, cheap and easily adaptable." Their input underscored the importance of not overcomplicating a familiar and effective aid.
- Discussions with Mechanical Engineering students at UCSB provided critical technical validation. They advised that integrating sensors and electronics into a cane would be more robust, feasible from an engineering perspective, and potentially more cost-effective to manufacture compared to the sensor vest. They also noted potential complexities with the vest concerning the feedback loop and processing power requirements.
- Insights from Professor Amit Ahuja (UCSB), a visually impaired individual who has used both a cane and a guide dog, validated the clear need for a solution that bridges the

gap between the limitations of a traditional cane in complex environments and the significant commitment required for a guide dog.

Based on this initial feedback, which combined direct user preferences with expert technical and practical insights, the NaviCane team made a strategic decision to pivot from the initial broader exploration and to concentrate development efforts on the enhanced smart cane concept. This early-stage research was instrumental in refining the product vision, ensuring it aligned with user needs, existing behaviors, and technical viability, thereby laying a user-centered foundation for the subsequent development of NaviCane.

10.4 Lessons Learned

If we were to go through this process again, one thing we could approach differently is conducting even more user interviews earlier in the process. While our feedback from the Braille Institute, UCSB professors, and engineering students was extremely helpful, having more firsthand feedback from a broader demographic of visually impaired individuals (especially those outside of academic settings) could have revealed even more nuanced needs and usability preferences. Additionally, we could have better documented every iteration in our prototype development to track exactly how user feedback translated into product changes. Another area for improvement would be allocating more time for market validation. We realized later in the process just how competitive and fragmented the assistive technology space is. A deeper dive into pricing strategies, long-term maintenance, and insurance coverage earlier on would have helped us shape a more robust go-to-market approach.

We did a great job applying design thinking *and staying agile throughout the process. One of our strengths was our willingness to pivot from an initial concept of a vest to a smart cane based on clear, user-centered evidence. We also effectively balanced technological feasibility with user comfort and affordability, thanks to great collaboration between engineering and business team members. Our use of both qualitative (interviews) and quantitative (market sizing, financial modeling) data allowed us to build a solution that was innovative yet grounded in real-world need.*

A major AHA! moment was when multiple users expressed a strong preference for the cane form factor over other devices like vests, glasses, or watches. While we initially thought a vest would offer superior coverage, users valued familiarity and simplicity even more. This highlighted the importance of not just functionality, but user experience and comfort in adoption. Another AHA! moment came from learning how subtle design factors, like the weight of the cane or bulkiness of added tech, could make or break its usability. These insights pushed us toward a minimalist, user-friendly design philosophy that shaped the final concept of NaviCane.

10.5 Action Shots