Senscape: An accessible landscape for all to escape to

Calvin Chen
University of California, Davis
Sacramento, CA, USA
kalchen@ucdavis.edu

Catherine Chen
University of California, Davis
Fremont, CA, USA
ccrchen@ucdavis.edu

Sauvikesh Lal
University of California, Davis
Redwood City, CA, USA
saulal@ucdavis.edu

Xiaolin Ma
University of California, Davis
Sacramento, CA, USA
xlma@ucdavis.edu

Jessica Trans
University of California, Davis
Patterson, CA, USA
jgtrans@ucdavis.edu

Sophia Tzonev
University of California, Davis
Pleasanton, CA, USA
sstzonev@ucdavis.edu

ABSTRACT

Senscape is a mobile application that aims to create safe and inclusive environments by providing real-time sensory information that allows users to find spaces that suit their preferences. It addresses the challenges faced by individuals with sensory processing disorders, anxiety disorders, migraines, visual impairments, and mobility limitations. Senscape empowers users to plan their visits to public spaces by informing them about factors such as crowd levels, noise levels, lighting, and accessibility features. The design process involved researching users' needs, defining the problem, brainstorming ideas, prototyping, and testing the prototypes with user feedback. By recognizing the need for a holistic approach to sensory challenges, the user feedback gathered was used to create current features in the mid-fi. Future work for Senscape includes collecting more user feedback data, incorporating additional features, creating high-fidelity mockups for the final app design, developing a web application alongside the mobile app, and implementing a verified business feature for data accuracy.

KEYWORDS

Accessibility, Human-Computer Interaction, Design, Design Thinking, User Research, Sensory Processing, Mobile Application

1 INTRODUCTION

While many apps help you navigate places, they often overlook sensory factors such as crowds, lighting, and noise levels. Senscape bridges that gap by providing real-time sensory information that allows you to find spaces that suit your preferences. Senscape is a project dedicated to creating safe and inclusive environments for everyone. One of its primary features is to inform users about the sensory environment in public spaces, helping them plan their visits and improve their overall comfort and experience.

Sensory overload is a prevalent issue affecting individuals for various reasons. It's not uncommon to dislike loud senses, whether it's for studying reasons, or an attention or developmental disorder, such as ADHD and autism. Senscape aims to address this by enhancing accessibility in places such as coffee shops and grocery stores, providing relief to those who struggle with sensory stimulation. Furthermore, Senscape can gather data from partnered stores, enabling users to schedule visits with minimal customers, thereby mitigating sensory overload. This inclusive approach ensures that a diverse range of individuals can benefit from the app, helping

them anticipate what to expect in unfamiliar places and alleviating any anxiety-associated feelings.

We decided to create an app like Senscape because many of us had issues with entering public spaces that ended up being too crowded or loud to stay productive in. We did some research to learn more about the different kinds of sensory issues people face in public spaces to define a set of target user groups. Then we performed extensive needfinding activities to gain deep insights into user requirements and pain points. These needfinding activities allowed us to create personas to aid in our understanding of our users. We also looked into potential competitors to learn more about ways to differentiate our product. Through surveys, personas, user interviews, and competitive analysis research, we gathered valuable data on user preferences, behaviors, and challenges. This information served as the foundation for our design process, ensuring that our solutions were tailored to meet the specific needs of our target audience. Following the needfinding phase, brainstorming sessions were held to explore innovative ideas and approaches for designs such as a logo, low-fidelity prototype of the app, and colors. Through collaborative discussions, we generated multiple design concepts that addressed the identified user needs and aligned with the project objectives. Lastly, through our prototyping phase, we created mid-fidelity designs to present to potential users for further testing.

2 BACKGROUND

Many individuals struggle with maintaining focus and concentration due to environmental factors such as sound level, smell, touch, sight, and more. According to a National Health Interview Survey conducted by the CDC in 2014, approximately 20% of adults have difficulty following conversations in loud backgrounds, and around 6% have sensitivity to everyday sounds (CDC, 2015). Recognizing these challenges is important because various individuals wish to study or engage in other activities outdoors but struggle to find places free from sensory distractions. This app aims to remove these barriers, enabling people to venture out and experience life to the fullest.

3 DESIGN METHOD

Our design process included five phases: Empathize, Define, Ideate, Prototype, and Test. Our rationale with this process was to ensure we were properly developing our ideas before moving on to other steps; if we had rushed and not fully expanded on our ideas through

each step, we may have had to deal with a very disjointed final product.

Our first phase, Empathize, involved research and design analysis. At this point, we wanted to understand the current state of the market and what users currently have access to. We did a thorough competitive analysis of similar products: Yelp, Google Maps, and Soundprint. This helped us understand the gaps in the market and what our target user groups would need to benefit from a new product such as ours. We then used a survey to get a sense of our users, and then went on to conduct eight in-depth user interviews to get insight into what specific sensory issues our target users had with public spaces and were able to validate our initial assumptions about the need for our product.

For our Define phase, we developed personas as well as a problem definition. Using what we learned from our initial interviews, we created four personas to give us guidance for later design decisions. Furthermore, we synthesized a problem definition as another guide for our product.

Next, our Ideate phase focused on Low-Fidelity Designs. We created initial sketches of the important features and user flows that we felt Senscape would need and planned to have continued iteration to define more details of the platform. We incorporated Nielsen's heuristics as we iterated our designs.

We then moved on to Prototype, where we expanded on our lo-fi designs by creating mid-fidelity prototypes in Figma. We made wireframes that took the most important design concepts, polished from our lo-fi sketches, as well as incorporating the necessary changes after conducting user testing to receive feedback about our initial design choices. Using these wireframes, we additionally created a user flow mockup. This phase also included logo creation.

Finally, our last design phase was Test, involving receiving final user feedback as well as reflecting upon our entire process of designing and testing Senscape. We recognize our product's potential, and have an awareness that there are still many aspects we can improve to make this an even better product for our users.

4 UNDERSTANDING THE USERS

We started by identifying five potential user groups: people with sensory processing disorders (SPD), anxiety disorders, migraines, visual impairments, and mobility impairments. Our goal was to create an app that helps users navigate public spaces by reducing overstimulation. For example, the app can help people with anxiety find calmer shopping environments and prepare for overwhelming public areas. Loud noises and bright lights, common migraine triggers, can be identified by the app to help users plan trips during quieter times or find areas with dimmer lighting. Additionally, visually and mobility-impaired users can access information about layouts, ease of navigation, and accessibility features like ramps, elevators, and seating areas.

To understand our target audience better, we conducted a survey focused on UC Davis community members. We received 19 responses, with 70% coming from our initial target groups. The survey revealed that crowded areas, tight spaces, and a lack of seating were the main factors hindering a positive experience in public spaces. Sensory overload came from loud noises, strong smells, large crowds, and bright or flashing lights.

Following the survey, we interviewed 8 participants. These interviews provided valuable insights into calming environments, public space concerns, and typical routines. People prefer serene environments with others quietly working, creating a focused atmosphere. Sudden loud noises were disruptive and distracting. Finding quiet spaces to concentrate was crucial. Large crowds, amplified noises, and visual clutter were overstimulating, leading to difficulty concentrating, headaches, and heightened anxiety.

Individuals typically plan public outings by researching layouts, noise levels, crowd density, and parking availability. This information reduces anxiety and helps set expectations, influencing the decision to visit or find alternatives. However, participants found current resources like Google Maps to be inaccurate and lacking information on noise levels, light, and visual clutter.

Based on the interviews, we created four user personas representing our refined user groups. We began conceptualizing and designing our app with these user personas in mind.

- **Susan (33, mother of child with SPD):** Wants to take her child outside for enjoyable experiences without overstimulation. Pain points include loud, crowded environments and bright lights.
- **Jimmy (21, college student with anxiety):** Wants to set expectations for public outings but experiences travel anxiety and feels overwhelmed in crowded spaces.
- **Daryl (27, software engineer with ADHD):** Needs quiet places to work remotely without distractions. Crowded cafes and workspaces present challenges.
- **Mary (74, retired teacher):** Seeks comfortable seating, flat sidewalks, well-lit areas, and accessible restrooms. Identifies "hostile architecture" that hinders her enjoyment of public spaces.

5 PROTOTYPING

5.1 Conceptual Model

We decided on creating our product as a mobile application, so Senscape can be accessible and inclusive for people on the go. Both Android and Apple users can enjoy finding comfortable places to visit in the public. Our app would help users to overcome sensory challenges by providing real-time sensory information in public areas such as stores and restaurants, which allows users to find spaces that suit their preferences. We would collect data from partnering stores and user reviews. This includes data about crowd levels, noise levels, lighting, and accessibility. Users can filter their searches using these criteria to find places that are comfortable for them. Mainly, our data would come from sensory-based reviews from other users. The reviews would have sensory information that the users experience, as well as pictures to help others know what to expect when they visit the location.

5.2 Low-Fidelity

Using rapid prototyping techniques, we created low-fidelity prototypes to test and iterate on our ideas quickly. These prototypes allowed us to visualize the user experience, gather feedback from stakeholders, and refine our designs through iterations.

The first phase of our low-fidelity stage is creating the logo. As our app aims to offer a welcoming and inclusive space, particularly

Figure 1: Logo iterations from sketch to vector form

Figure 2: Home view, search view, map view

for individuals with sensory processing disorders, we envisioned our logo to reflect environments known for their tranquility and serenity. Given that our app's name, Senscape, combines "sense" and "landscape", we opted to integrate natural elements into the design. Our iterative process led us from initial concepts featuring serene mountain peaks and sunsets to the serene expanse of the ocean, featuring a whale. The choice of a whale was intentional, as these creatures are often associated with peaceful imagery and soothing sounds in popular media. Their complexity and diverse behaviors parallel those of humans, aspects we aim to highlight and accommodate within our application. We aimed to utilize concepts of emotional design, like visceral behavior, through chalk-like design. The chalk effect invokes calm and nostalgic feelings of childhood that convey comfort and recovery.

As we worked on the logo, we began to sketch out the app with our digital tablet and brainstormed ways to incorporate the helpful features that users wanted to see. The main elements that we integrated into the low-fidelity sketches were a simplistic user interface, a map view of sensory details in nearby areas, and a filtered search.

In our initial lo-fi sketch, we began with fundamental concepts that were kept in mind for further refinement. Our focus was primarily on delineating user flow between various pages, incorporating a sidebar, and establishing a navigation bar. At this stage, we sketched our designs to encompass a home page, a user page, and a map/search page. Subsequently, in our next iteration, we combined the sidebar into the bottom navigation bar. This decision was made through considerations of emotional design, aiming to streamline user interaction and mitigate potential confusion by consolidating features into a singular location.

By relocating the sidebar to the bottom navigation bar, we aimed to enhance user experience by minimizing the need to consult multiple locations for features. Our final lo-fi iteration represented a further expansion of the initial lo-fi, introducing new pages tailored for specific locations or businesses. During this phase, we continued to utilize concepts from Nielsen's heuristics, particularly emphasizing aesthetic and minimalist design principles (Nielsen, 1994).

Given the substantial information our app aims to provide, we incorporated tabs for distinct sections—namely, info, gallery, similar, and reviews—to prevent clutter and facilitate user navigation. Following this iteration, we continued to solicit user feedback to inform the development of our mid-fi prototypes.
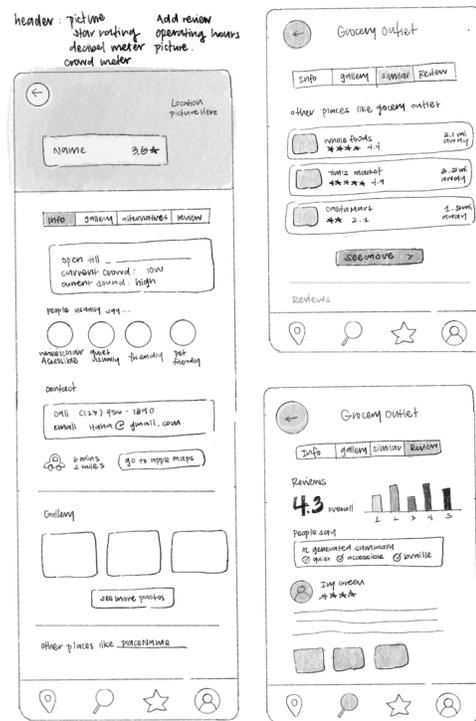

Figure 3: Location info, gallery, similar, and reviews

5.3 Mid-Fidelity

In the mid-fidelity prototype, Senscape adopts a multi-page design for its mobile app. A navigation bar at the bottom provides easy access between the home screen, map view, favorites, and settings page. The home page offers general recommendations and categories alongside a search bar for finding specific locations. Users can filter their searches by noise and crowd levels to pinpoint places that align with their sensory preferences. Selecting a location from the search results directs users to a page with images, sensory-based reviews, and similar location suggestions.
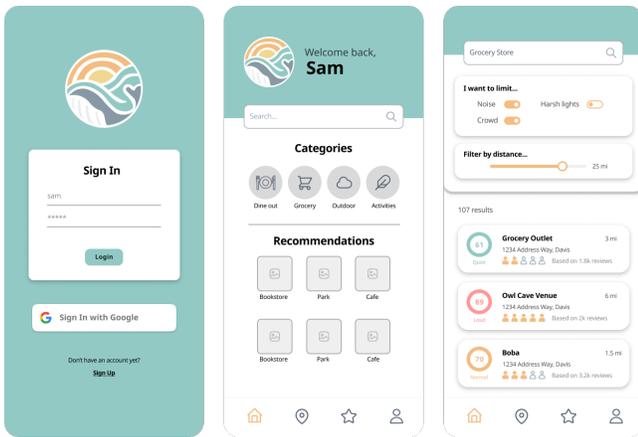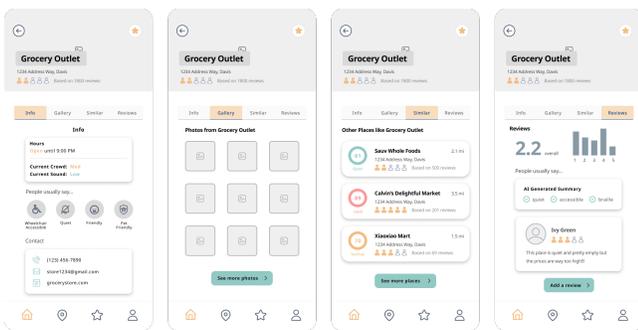
Figure 4: Login View, Home View, Search View

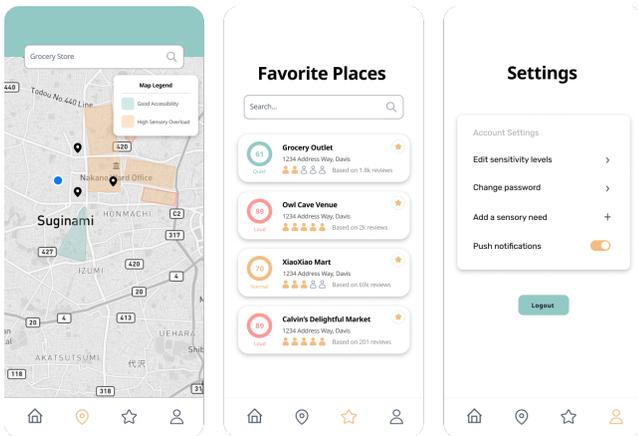
Figure 5: Location View

Figure 6: Map View, Favorites View, Profile View

In response to user feedback, the location rating system has been revamped. Star ratings have been replaced with a crowdedness level indicator, providing users with real-time information about how busy a place is. Additionally, the number of user reviews is provided to give users a general sense of the data's accuracy.

The mid-fi wireframes prioritize consistency and standards by employing consistent colors, typography, and icons across all screens (Nielsen, 1994). For Senscape, the chosen font, Noto Sans, strikes a balance between readability and aesthetics, ensuring clear information display without sacrificing a clean and stylish look. This consistency fosters intuitive use and allows users to learn the app quickly. Recognition rather than recall is another key principle applied in the design (Nielsen, 1994). Elements, actions, and options are constantly visible throughout the app. For instance, the location information page clearly labels all features, such as photos and reviews, eliminating the need for users to memorize information from one screen to another. Although not depicted here, the settings page is envisioned to include functionalities such as allowing users to adjust their sensitivity levels and incorporate additional sensory needs for refined searches and visit planning. This page would also house documentation and instructions to guide users through the app's functionalities.

The working Figma prototype is linked here: **Senscape Figma Prototype**.

5.4 User testing

In regards to our methodology, we decided that user testing was very important for our design iteration because we wanted to make sure we were considering the thoughts of the people who would benefit most from Senscape, so we completed user testing after each stage.

Our procedure involved contacting people in our user groups from our early survey. We provided a background on the current step we were at in the design process. We then gave the details of our design, with a focus on the new details that were not there in the last step or iteration, and asked for thoughts on any strengths or weaknesses in the concepts or designs. Additionally, we made sure to leave time for asking the user any questions they had about the design, and whether there was anything that stood out as being very important, or in contrast, any features that they felt were glaringly missing and whose absence would lead to annoyance or frustration.

Analyzing these interviews needed to be done with careful consideration to ensure we did not automatically take everything the users said at face value. We needed our design to be what these users would need, not simply what they indicated they wanted. To do this, we cross-referenced the comments we received with the planned designs and concepts for other parts of our product, especially in the earlier stages of the design process where we had not yet fully expanded our design ideas into a prototype.

Importantly, our results for each stage of user testing reminded us that getting feedback from our target users should always be a priority: after all, these are the people we are building Senscape for. Keeping their opinions in mind throughout the design process was always a goal for us. The more continuous feedback we receive, the more useful our product will be for our users, and the easier it is for us as designers to efficiently iterate on our designs and ideas. For example, the user testing we conducted after completing lo-fi sketches was instrumental in developing mid-fi wireframes.

If we had waited until after an initial mid-fi wireframe was complete, incorporating user feedback would have been much more frustrating.

6 DISCUSSION

Throughout this project, our team has undergone a profound learning experience in the application of the design thinking methodology. This structured approach with five distinct stages has provided us with a clear and systematic framework, rendering the entire journey both manageable and logical. Each stage has served as a stepping stone, facilitating the progression of our project in a coherent manner.

Undoubtedly, the ideate stage emerged as a highlight of our journey. Here, we were allowed to express our creativity and brainstorm innovative solutions. It was during this phase that our ideas evolved from concepts to attainable solutions, laying the groundwork for the subsequent stages of development.

However, our journey was not without its challenges. One notable obstacle we encountered was the initial difficulty in sourcing suitable candidates for interviews. Nevertheless, leveraging the expansive reach of our team members' social media platforms proved instrumental in overcoming this hurdle, enabling us to secure a sufficient pool of participants for our surveys.

Furthermore, another challenge we faced revolved around the utilization of Figma for creating mid-fi designs. Given that our team predominantly comprises developers, we were limited by our unfamiliarity with Figma. Nonetheless, as our designs underwent iterations and improvements, so too did our proficiency with Figma, underscoring our team's adaptability and capacity for skill growth.

One of the key realizations we made during this journey was the niche our app could occupy in the market. Unlike existing solutions, which only marginally address sensory processing disorders or focus on singular sensory issues, our app presents a comprehensive approach to assist individuals facing these challenges. We recognized the opportunity to introduce a novel concept that would fulfill a significant need within the market, promising a fresh perspective and enhanced usability for our target audience.

7 FUTURE WORK

We plan to take the feedback we received from user testing to iterate on our mid-fi mockups. Next, we'll create high-fidelity designs to solidify the app's look and feel before diving into development. To ensure broad accessibility, we'll be building both a web application and a mobile app. The mobile app will leverage React Native, Redux, and React Navigation for a smooth user experience, with Node.js handling the backend logic. For the web application, we'll be using the MERN stack, which combines MongoDB, Express.js, React, and Node.js to create a robust and efficient web platform.

Based on feedback gathered from user interviews and following up with those that we interviewed, we identified additional features to enhance the application. These include introducing additional sensory filters for users with sensitivities to smells or vestibular disorders. Additionally, providing accurate year-round data poses challenges due to fluctuations in crowd levels caused by events like holidays or unexpected world events. To address this, we propose implementing a verified business feature. This feature would

Figure 7: Group Picture

involve close collaboration between businesses and our app to provide accurate business operation data, crowd levels, and upcoming events. Verified businesses will receive visibility and priority placement in search results, benefiting both users and businesses alike.

8 PEER RATING

Throughout this project, we believe that we have split up the workload evenly for each stage of the design process.

Calvin Chen: 16.67%, Contributed to idea development and participated in writing proposal/progress report. Created mid-fi mockups and iterated on designs.

Catherine Chen: 16.7%, Major contribution to idea development and needfinding, created surveys and conducting interviews, contributed to logo and app idea development, and participating in the writing of proposal/progress report/final presentation.

Sauvikesh Lal: 16.67%, Major contribution to needfinding, idea development, participating in the writing of proposal/progress report, brainstorming questions for user interviews.

Xiaolin Ma: 16.67%, Logo design, low-fidelity sketches, idea development, and participating in the writing of proposal/progress report.

Jessica Trans: 16.67%, Major contribution to needfinding, creating the logo and mid-fi designs on Figma, and participating in the writing of proposal/progress report.

Sophia Tzonev: 16.67%, Major contribution to needfinding, idea development, low fidelity sketches, and participating in the writing of proposal/progress report

9 APPENDIX

The Senscape Figma prototype is linked here:

https://www.figma.com/proto/NYw4YLmG9aQVk4e0IsF440/Senscape?type=design&node-id=25-7572&t=rDQ9uVmlBuGiM6na-1&scaling=scale-down&page-id=25%3A3&starting-point-node-id=25%3A7572&mode=design.

Calvin Chen, Catherine Chen, Sauvikesh Lal, Xiaolin Ma, Jessica Trans, and Sophia Tzonev

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