



Plant Care & Stress

FINAL REPORT

PREPARED BY:

Ruotong Gao
Mengyun Liu
Mandy Wang
Liwen Wu



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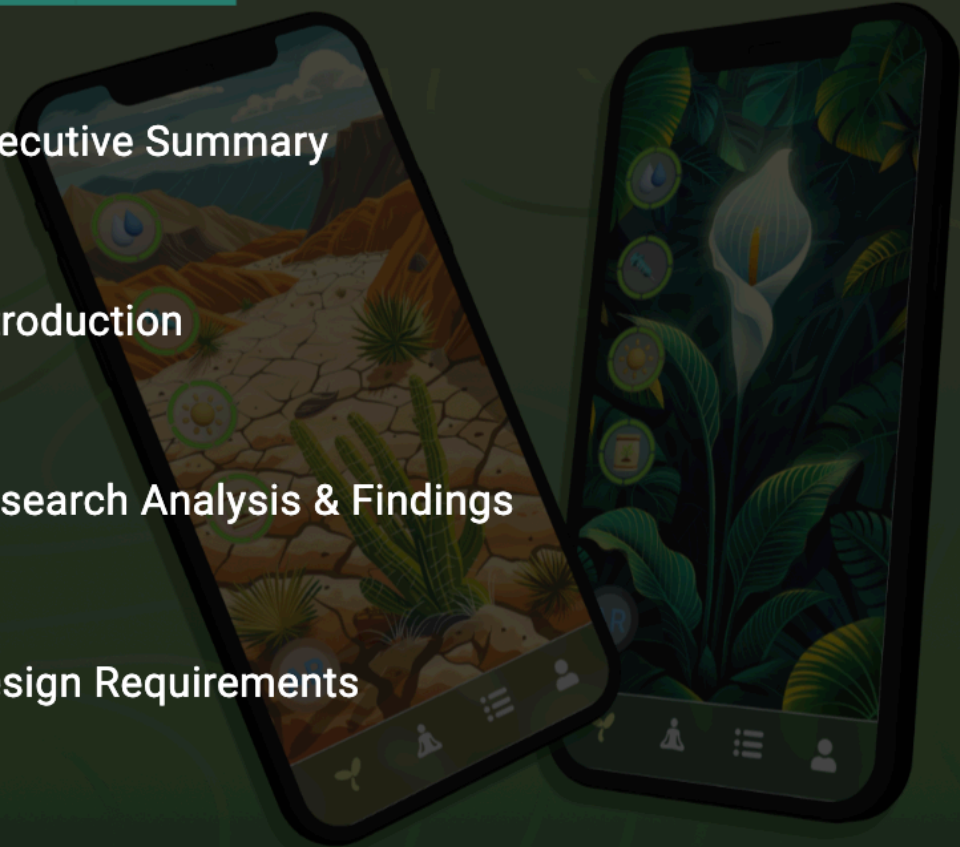
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EXECUTIVE SUMMARY



In response to heightened stress levels in contemporary society, we crafted an augmented reality (AR) app aimed at bolstering mental wellness through digital plant care and meditation. Our app endeavors to offer users an accessible and informative digital plant care experience, fostering mental health improvement through interaction with nature. Drawing from a comprehensive review of literature, surveys, interviews, and competitive analysis, we discerned key user preferences, including enjoyment in plant care, appreciation for nature connection, and the efficacy of mindfulness and meditation exercises for stress relief. Augmented Reality emerged as a favored feature, alongside the importance of community engagement and accessibility. Guided by these insights, we established four design requirements: prioritizing nature-connected digital engagement, integrating AR technologies with gamified interaction, implementing customizable meditation features, and ensuring accessibility for users with visual impairments. Our recommendations include a comprehensive plant care feature encompassing watering, sunlighting, diagnosing plant symptoms, and fertilizing, as well as an immersive AR-based interaction with plants and personalized meditation experiences. Although time constraints prevented the development of a community feature, we intend to address this in future iterations, refining our product based on user feedback. Despite areas for improvement, our app offers a novel approach to combining plant care and mental health improvement, contributing to heightened awareness of stress relief and the mental health benefits of plant care.

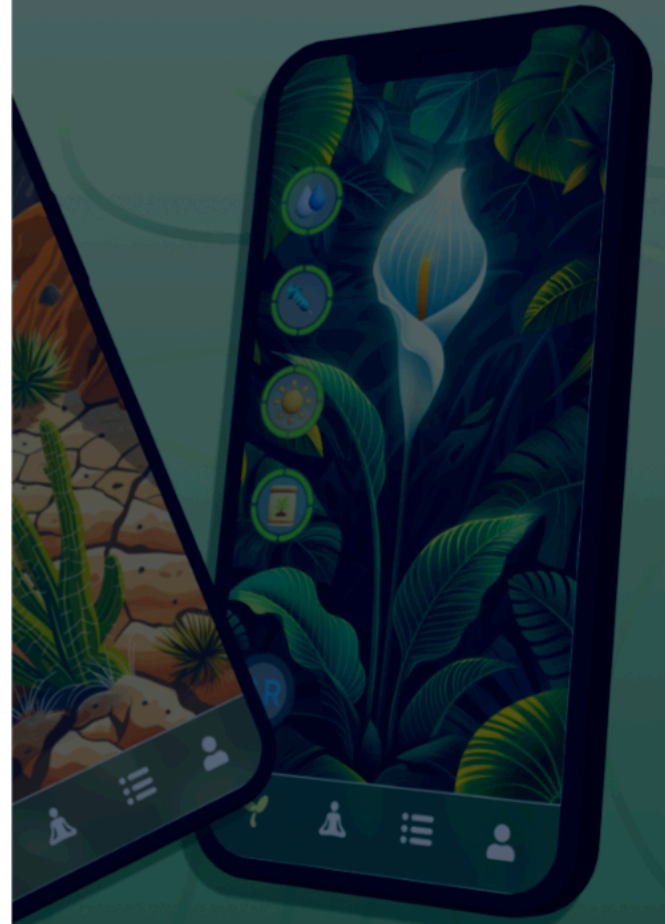
INTRODUCTION

MOTIVATION

The prevalence of stress and its impact on mental health has been a growing concern in recent years, with 74% reporting feeling too stressed or unable to cope in the past year (American Psychological Association, 2022). Besides, nearly two out of five (37%) Americans rated their mental health as only fair or poor, up from 31% a year ago (American Psychiatric Association, 2021) Given these concerns, we pay attention to the potential of digital plant care as a therapeutic method because digital plant care can mirror the stress-reducing benefits of physical plant care, offering a manageable solution to enhancing mental health.

PROJECT GOALS

This project aims to enhance mental well-being by providing a digital platform for virtual plant care and meditation. By offering virtual plant care activities and nature-integrated meditation sessions, the platform serves as a comprehensive tool to reduce stress and foster a deeper connection with nature. This holistic approach not only deepens user engagement but also promotes a greater understanding of how virtual interaction with nature can improve mental health.



RESEARCH

KEY RESEARCH QUESTIONS:

1

How do users prefer to interact with digital plant care and exploration applications?

2

What types of interaction modalities within digital plant care and exploration, such as gamification or AR/VR, do users prefer?

3

What specific features or functionalities in digital plant care and exploration facilitate a reduction in stress levels?

RESEARCH PLAN:



Literature Review

Conducted an in-depth examination of scholarly articles to explore how plant care activities influenced stress levels and contributed to stress management and improvements.



Interview

Gathered qualitative insights through interviews focused on user preferences for interaction modalities in digital plant care and stress relief applications, aiming to understand the specific needs and desires of the target audience.



Survey

Utilized surveys to quantify and validate user preferences for specific features and interaction modalities in digital plant care and stress management applications, as identified through literature review and interviews.



Competitive Analysis

Evaluated existing digital plant care and mental health to identify feature designs, user preferences, and gaps in the current offerings, providing direction for product design and differentiation.

RESEARCH ANALYSIS

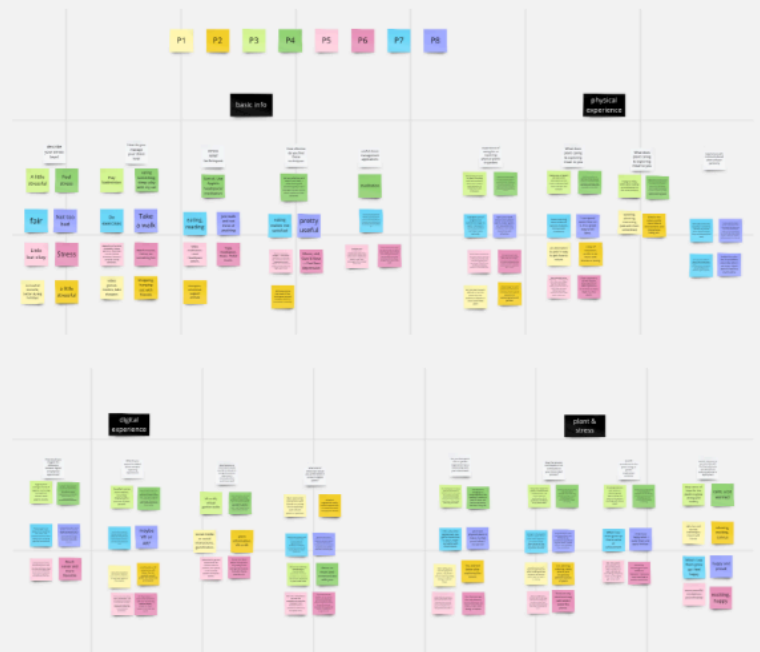
LITERATURE REVIEW

We utilized Zotero to systematically review and organize 11 research articles on nature-connected activities including gardening and virtual plant care within the stress management and mental health context. This literature review confirmed a strong correlation between plant care and stress reduction, supporting the use of virtual plant care as an effective stress management tool.

Title	Creator	Date	
✓ A Comparison of Leisure Time Spent in a Garden with Leisu... Full Text PDF	Ottosson and Grahn	2005-01-01	
✓ Association between indoor-outdoor green features and ps... Our preliminary results discussed so far highlight the diff...	Spano et al.	2021	
✓ Development of Evidence-Based Rehabilitation Practice in ... The intervention started at the end of April 2016 and last...	Trkulja et al.	2021	
✓ Home Garden With Eco-Healing Functions Benefiting Ment... A home garden has been proved to improve mental heal...	Zhang et al.	2021	
✓ Ornamental Plants Used for Improvement of Living, Workin... Thus, NASA astronauts indicate the practice of hobbies t... Full Text PDF			
✓ Pandemic, social isolation and the importance of people-pl... Although contact with nature in the real world is preferre...	Reis et al.	2020	
Plant Robot for At-Home Behavioral Activation Therapy Re...	Bhat et al.	2021	
✓ Potential of a Small Indoor Plant on the Desk for Reducing ... Our study indicates that having opportunities to gaze int...	Toyoda et al.	2020	
✓ The Ecological Self: Metaphor and Developmental Experien... Full Text PDF	Spitzform	2000-07-01	
✓ The Effects of Greenhouse Activities on Psychological Stres... The 6-week treatment sessions focused on the participan...	Kelley et al.	2017	
✓ Therapeutic Landscapes: An Evidence Based Approach to D... Google Books Link	Marcus and Sachs	2013-10-21	

INTERVIEW

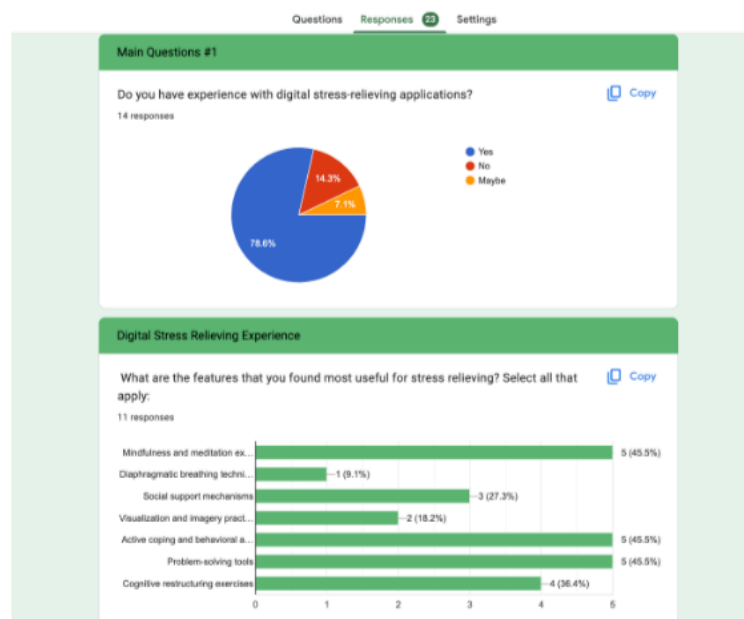
We conducted semi-structured interviews with eight participants diverse in their experience with plant care by using Zoom and in-person settings. We explored their experiences with plant care's impact on stress and their preferences for digital interactions, using Google Docs for collaborative note-taking and Miro for low-level affinity wall analysis, which helped identify key themes and design insights.



RESEARCH ANALYSIS

SURVEY

We designed and distributed an online survey via Google Forms to validate insights from earlier research stages. We analyzed 23 responses to gather insights on people's expected features and functionality related to digital plant care and stress management within our application, and used the built-in analytics to create bar charts to summarize and highlight user preferences.



COMPETITIVE ANALYSIS

We reviewed eight products related to digital plant care and mental health benefits to evaluate their interaction modes and user stress expectation. This competitive analysis helped us gain a broad understanding of related products and know how different elements are valued and what are unmet requirements, guiding our product design and differentiation.

	Stressbusters	PictureThis	Headspace	Habitat XR	Travel Frog	Komi	Ant Forest	Forest
Competitor Type	Partial Competitor	Indirect Competitor	Partial Competitor	Analogous Competitor	Analogous Competitor	Partial Competitor	Analogous Competitor	Partial Competitor
App Type	Stress Management for Students	Plant Identification and Care	Mindfulness and Meditation	XR Environmental Education	Serenity Game	Biofeedback Pet Robot	Gamified Environmental Conservation	Focus and Productivity
Main Features	Multiple stress management methods, updates content	Plant identification and disease diagnosis, gardening advice	Guided meditations, VR, social community	Immersive VR experiences, storytelling	Laissez-faire gameplay, adventure	Stress level detection, customizable feedback	Virtual tree growing, real-tree planting	Tree growth simulation, real-tree planting
Visual Design	Outdated, needs updates	User-friendly, accommodates color blindness	Modern, engaging	High-quality VR visuals	Minimalist, calming	Simplistic, needs emotional depth	Fun, engaging	Simple, engaging
User Experience	Clunky navigation, informative	Text-heavy, straightforward navigation	Intuitive, gamified	Deeply immersive, educational	Simple, intuitive	Immediate feedback, lacks depth	Community-focused, rewarding	Motivating, visually appealing
Inspirations	Update content, integrate diverse methods	Quick identification, helpful gardening tips	Personalization, community integration	Strong storytelling, emotional impact	Peaceful gameplay, emphasize simplicity	Enhance emotional interaction	Combine virtual activities with real impact	Use gamification for real-world benefits

RESEARCH FINDINGS

LITERATURE REVIEW:

1

Extensive research has consistently shown that green plants in various settings alleviate stress and enhance mental well-being, with specific benefits noted in healing gardens and therapeutic landscapes.

2

Activities like gardening, both in physical and virtual formats, are linked with attention restoration, stress reduction, and increased physical activity, proving beneficial for psychological health.

3

Innovative approaches like virtual reality (VR) plant experiences and plant-like robots are effectively broadening access to plant-based therapies, offering significant mental health support in isolated conditions.

INTERVIEW:

1

Most participants reported experiencing a sense of relaxation and satisfaction from their interactions with plants, highlighting its positive impact on their emotional well-being.

2

The interviews also highlighted that caring for plants serves as a meaningful way to engage and connect with the natural world from daily life, bringing a profound sense of joy and fulfillment that can effectively mitigate stress.

3

Participants noted the demands and stresses of physical plant care, such as the anxiety over plant health, contrast sharply with digital plant care which offers ease and accessibility and reduces the fear of loss.

4

Digital platforms are appreciated for their stress-free environment, allowing users to explore plant care without the consequences of real-world mistakes, making it an appealing introduction to the world of plant care.

SURVEY:

1

Users find digital applications with features like mindfulness and meditation exercises extremely effective for stress relief.

2

Positive responses to sensory elements such as music and color in apps highlight their importance in enhancing the therapeutic effects of digital stress relief tools.

3

Simpler plant care tasks are preferred for their stress-reducing effects, while complex tasks are less favored, indicating the need for simplicity in app design.

4

The survey underscores the importance of social features and personalized settings in enhancing user engagement and satisfaction within digital plant caring apps.

RESEARCH FINDINGS

COMPETITIVE ANALYSIS:

1

Stressbusters and PictureThis offer diverse stress management methods and plant care features. These apps demonstrate the importance of user-friendly interfaces and regular content updates.

2

Travel Frog and Komi offer a serene gaming experience with minimalistic interaction, focusing on anticipation and discovery which helps in stress relief, which underscores the value of simplicity and passive engagement.

3

Headspace and Habitat XR use advanced XR technologies to deliver immersive experiences that enhance user engagement, demonstrating the potential for similar technologies in our digital plant care platform.

DESIGN REQUIREMENTS

Nature-Connected Digital Engagement



- Create a digital space mirroring nature's essence for stress relief.
- Offer a variety of plant-related activities and knowledge to cater to users' nature cravings.

Innovative and Immersive Interactions



- Use VR/AR and gamification to offer engaging, interactive experiences.
- Simulate physical plant care in a digital environment, making it enjoyable and stress-reducing.

Customizable Music for Meditation

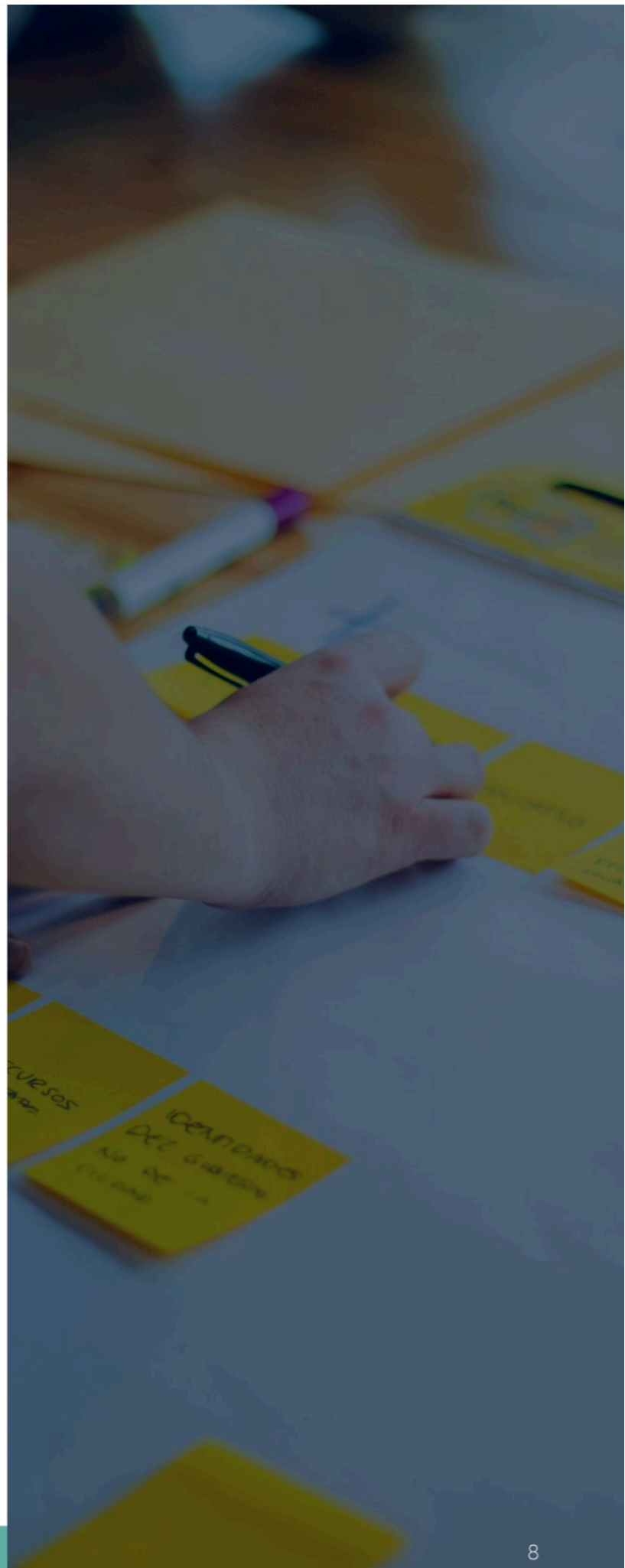


- Incorporate meditation and music as key stress-relieving features.
- Allow personalization of music choices to enhance the meditation experience.

Accessibility



- Consider individuals with color vision deficiencies, as well as the readability of text and images.
- Employ aesthetics that are widely accepted and used today.



CONCEPT OVERVIEW

Users interact with virtual plants in a serene digital environment. Key features include AR plant nurturing, accessible meditation with customizable elements, and prompts for plant knowledge. It also encourages offline activities and community connections to promote overall wellness.

AR Feature



Incorporating AR can bring digital plants into the user's physical environment, which offers a novel approach to fostering a connection with nature.



Plant Care Activities

To keep the digital plants in good health, users can perform regular plant care activities such as watering, providing sunlight, and fertilizing.

Meditation

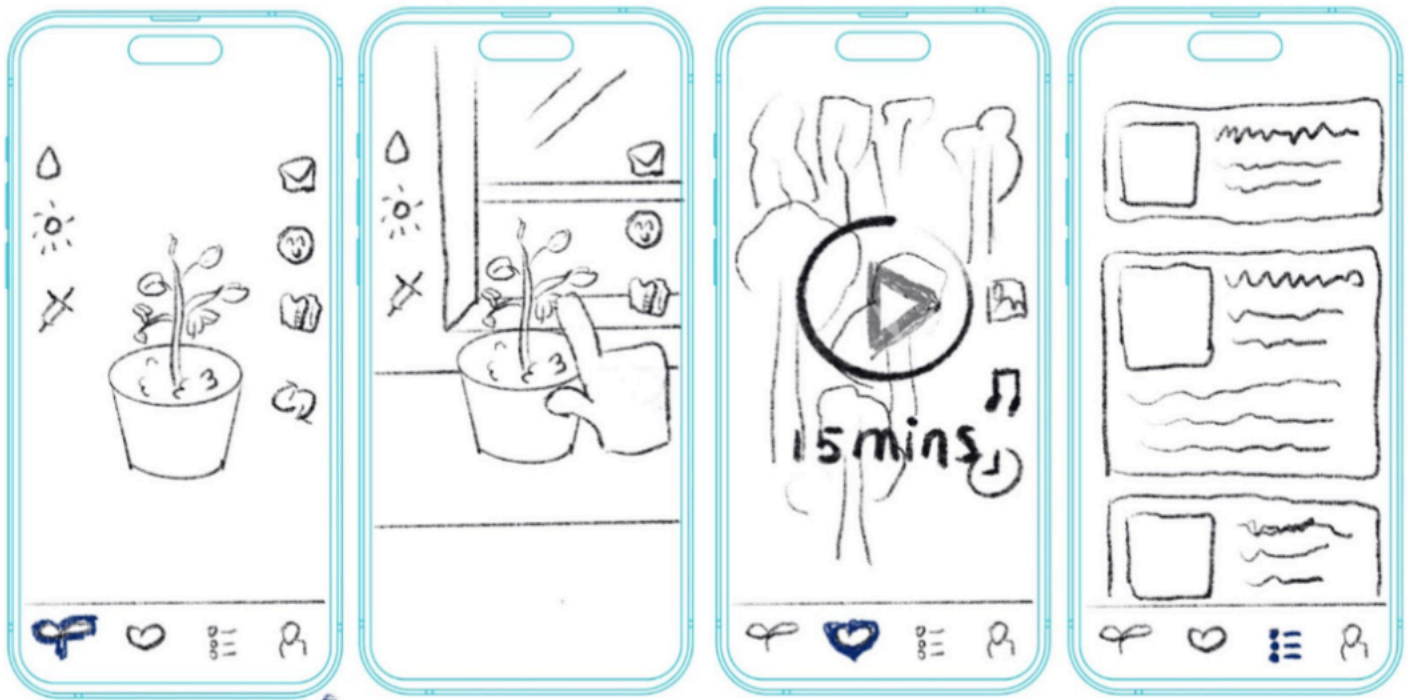


The app's meditation feature provides users with an opportunity to practice settling down their minds according to their personal needs and preferences.



Inclusive Touch

The app includes accessibility features to accommodate users with color blindness, ensuring that the benefits of the app can be enjoyed by a diverse user base.



ITERATION PROCESS



Low-Fidelity Prototype

We crafted a low-fidelity prototype using simple paper materials during team sessions. This low-fidelity prototype consists of 4 main features, which are,

- Plant care: watering plants, sunlighting, diagnosing plant symptoms, and fertilizing.
- AR feature that allows users to observe their plants in a physical world setting, interact with their plants, and plant information checking.
- A letter greeting from the plant
- Meditation: customizing the timer, background music, and pictures

We ensured smooth testing by including all necessary navigations and enabling quick iterations. Additionally, the paper prototype allows for easy transitions between pages and changes in interaction types, facilitating usability tests.



First Round Usability Testing

This phase* focused on concept validation, navigation, and user flow:

- Usability Issues: Identify navigation difficulties, unclear user flows, or confusing areas.
- Concept Validation: Verify if the solutions align with user needs and expectations.
- Feedback on Features: Gather feedback on specific features or functionalities.

* Paper prototype user testing: <https://docs.google.com/spreadsheets/d/1g3qhXeyzGzx30SF0Mh-e3gApqPrMu3-q9kCP6G7V7VIA/edit#gid=0>

 PHASE

Low-Fidelity Prototype

First Round Usability Testing

High-Fidelity Prototype

Preference Test & Second Round Usability Testing

Final Design

ITERATION PROCESS



High-Fidelity Prototype

After evaluating the low-fidelity prototype, we moved on to building a high-fidelity version using Figma, a collaborative online platform. This high-fidelity prototype included advanced interactions and visual elements, providing a detailed representation of the final product. We also explored creating a high-fidelity AR prototype. This prototype was integrated into the Figma design, allowing users to experience augmented reality elements within the overall prototype. By incorporating AR technology, we aimed to deliver an immersive and engaging experience that aligns with our project goals.



Preference Test & Second Round Usability Testing

This phase focused on visual design, interaction quality, and overall user experience:

- **Visual Design:** Evaluate the intuitiveness of the app layout, the readability of text and images, and the application of contemporary design aesthetics.
- **Interaction:** Assess the responsiveness and performance of features and ease of access.
- **Overall Experience:** Evaluate the overall user experience and emotional response.

PHASE

- Low-Fidelity Prototype
- First Round Usability Testing
- High-Fidelity Prototype
- Preference Test & Second Round Usability Testing
- Final Design

Final Design

The majority of the evaluations' findings have been incorporated into the final design, which underwent multiple rounds of modifications and tests in Figma. The resulting prototype is interactive, featuring animation, AR capabilities, and sound interactions.

KEY FINDINGS

1. Intuitive Icon Choices

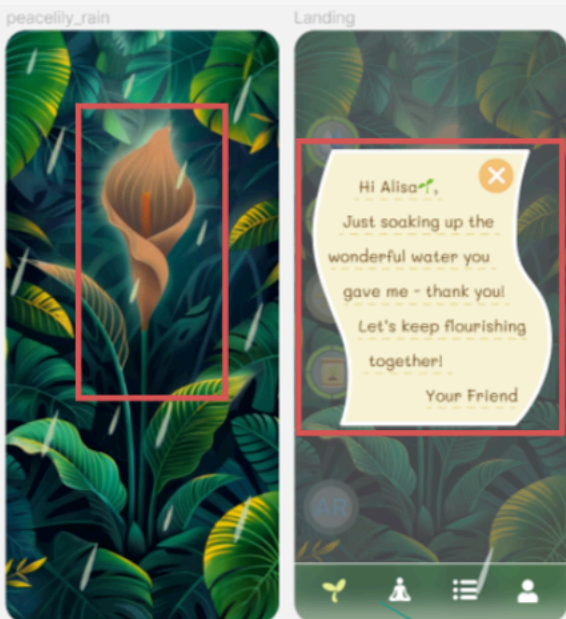
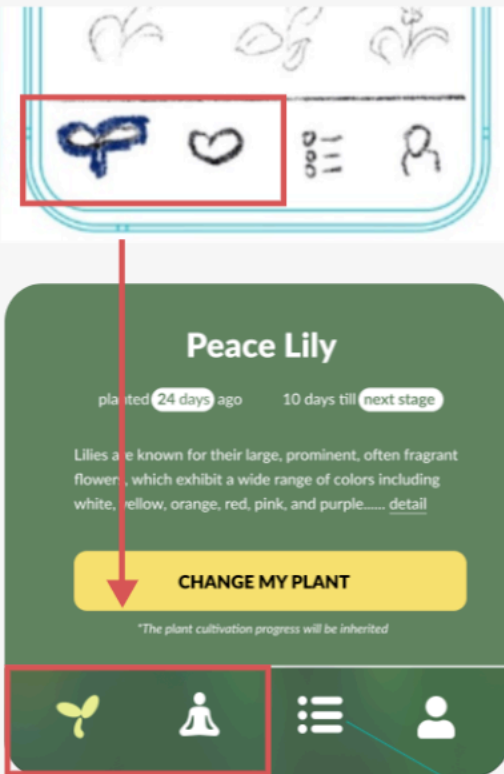
Users faced challenges while interacting with the "leaf" icon, which is the element in navigating to the plant category page since its function was not immediately clear, and caused initial confusion. Feedback from users also suggested confusion about the functionality or significance of the meditation icon, indicating a potential usability issue. Additionally, users encountered difficulty in changing the music, unable to differentiate between the music icon and the music list icon, indicating a need for more intuitive guidance and clearer iconography.

In the subsequent phase of design iteration, we modified the interaction path of the plant category page, the meditation icon from the heart to a yoga-style character, which appears to be more acceptable and intuitive to the users.

2. User Fulfillment and Engagement

Users suggested a need for immediate confirmation or feedback after completing the care of the plant. They suggested an animation or another visual prompt to notify users that an action has been successfully performed, or a progress bar to inform users of the operation's progress. In addition, they also provided feedback indicating a desire for additional plant animations to offer both short-term and long-term growth feedback. This enhancement aims to engage users more effectively and elevate overall satisfaction levels.

In the final version of the design, we added completion messages and completion animations after plant care operations, aiming to provide more cues and feedback and allow users to better perceive plant growth and task completion.

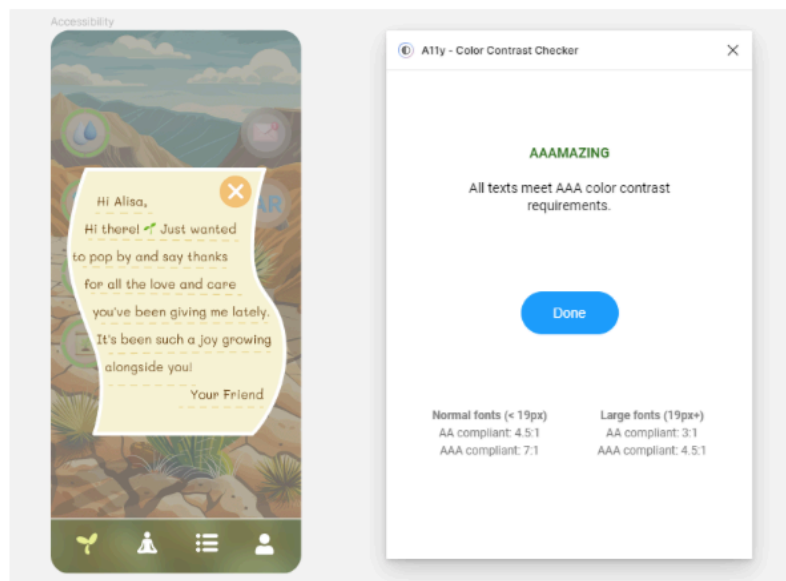
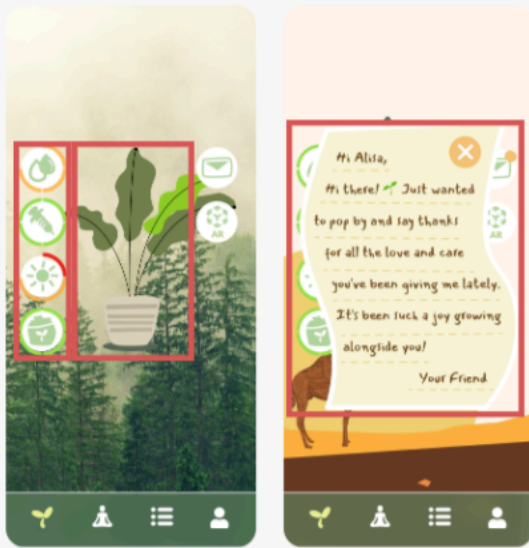


KEY FINDINGS

3. Immersive and Accessible Visual Preferences

In user feedback, preferences varied among icon sets, emphasizing the importance of achieving a harmonious blend of engaging design and coherence within the interface. Users expressed appreciation for the immersive atmosphere created by the AI-generated plant, though some expressed minor concerns about its integration and familiarity with the app's environment. Despite differing opinions, there was a shared preference for a handwritten aesthetic that strikes a balance between charm, functionality, and consistency throughout the interface.

In response to feedback and time constraints, we chose 3D icons for completeness and aesthetic appeal, transitioning hand-drawn icons for visual consistency. AI-generated plants were integrated, and icon sets adjusted for cohesion. Hand-drawn aesthetics were retained for messages with improved readability through updated typefaces, balancing charm and accessibility.



We conducted a WCAG check on each page of our design to guarantee accessibility compliance.

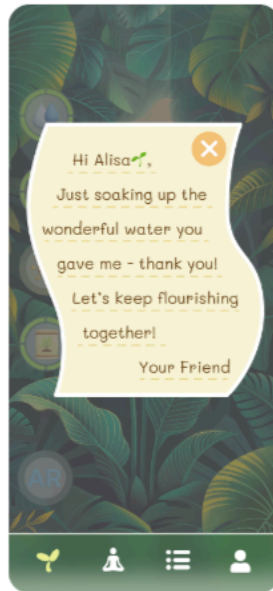
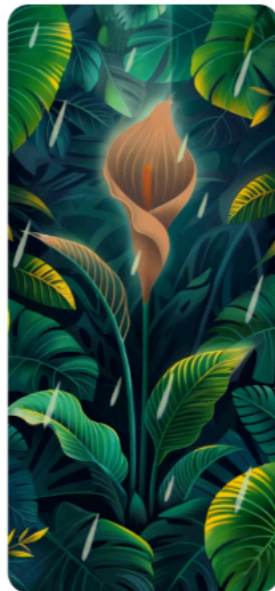
FINAL DESIGN

Link to the final design video:

<https://drive.google.com/drive/folders/1vpm-EXS2zKl6bEmSTd9jDxD1wBbaHPDY?usp=sharing>

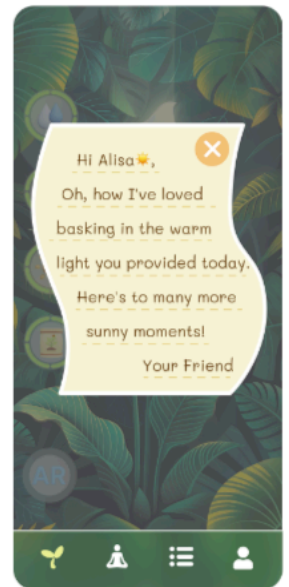
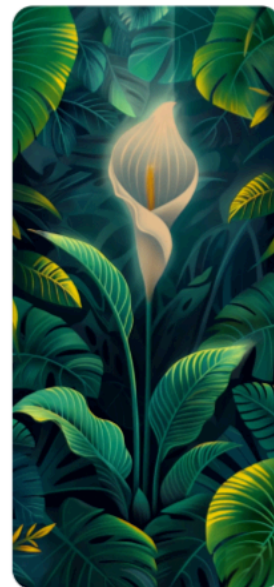
Link to the Figma final prototype:

<https://www.figma.com/proto/Z2WKBkrtUeHpYqGmbDQCn?page-id=0%3A1&type=design&node-id=67-356&t=jbvIXLc8aQoHrOIS-0&scaling=scale-down&starting-point-node-id=67%3A356>



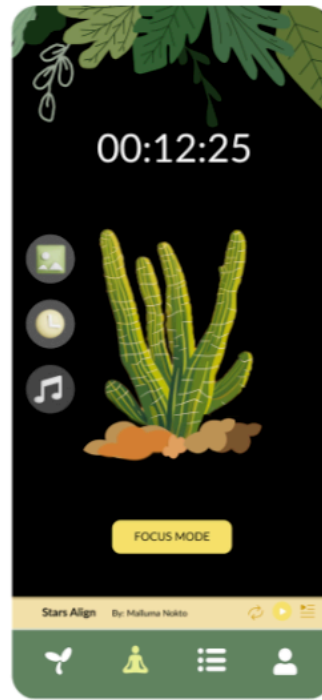
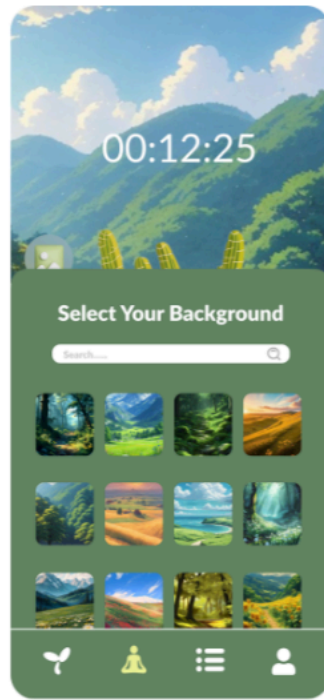
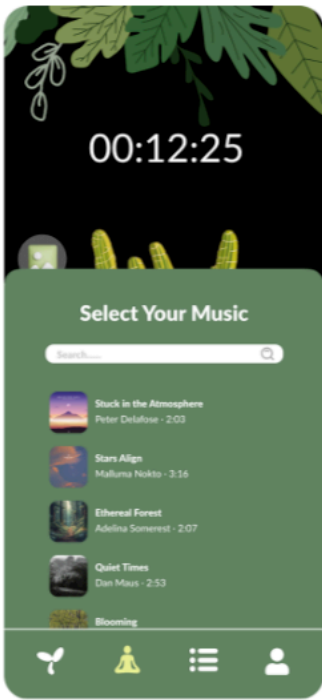
The color codes (red for critical/emergency, yellow for needs attention, and green for healthy) were defined based on feedback from paper prototype testing, where users demonstrated an intuitive understanding of the meanings behind each color.

While the color codes effectively communicate the plant's condition, feedback from user testing highlighted the need for an additional indicator to accommodate users with color blindness. Addressing this accessibility concern, the circular progress bar serves as an alternate visual cue for the plant's health, ensuring the interface remains inclusive for all users.



1. PLANT CARE

On the left side of the screen are four icons representing watering, sunlight, and fertilizer - essential elements for proper plant growth and maintenance. To help users quickly assess their plant's status, a color-coded level indicator and circular progress bar are prominently displayed.



The meditation section consists of music, images, and a timer. Upon entering the meditation page, the default display features an image of the user's plant accompanied by a default meditation track. On the left side are three icons corresponding to image change, timer settings, and music selection functionalities. Users can click the second icon to set the duration of the meditation. After setting up the timer users can begin meditating with the default music and picture, where the screen displays an image of their plant accompanied by an animated music waveform. This design choice comes from feedback during usability testing, where users said that they want to establish a connection between the meditation feature and their plants.



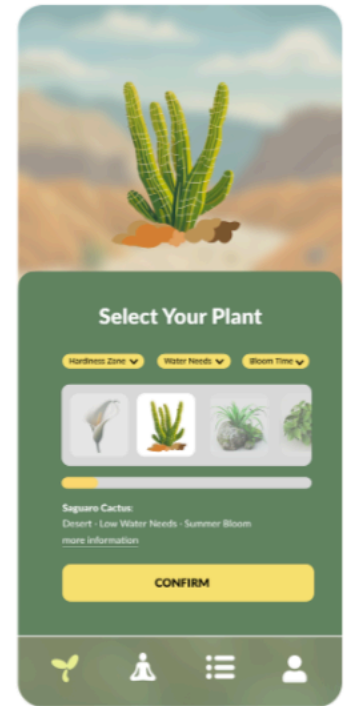
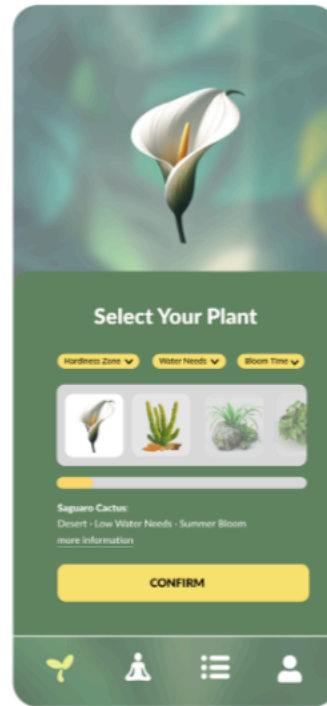
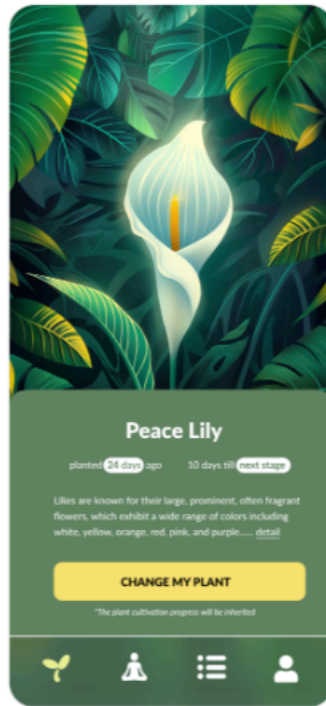
2. MEDITATION

The meditation feature is designed for flexibility and personalization, allowing for a tailored approach to meditation, accommodating individual preferences, and enhancing the overall calming effect.



Innovative Breathing Experience

Additionally, we've calibrated the waveform to reflect a reasonable breathing rhythm, allowing users to synchronize their breathing with the visual cues, facilitating a deeper meditation experience.



3. PLANT SELECTION

Clicking directly on the virtual plant displays a popup window at the bottom of the screen, summarizing key details about the plant. Within this popup window, users can choose to explore and select a different plant by clicking on the "Change Plant" option.

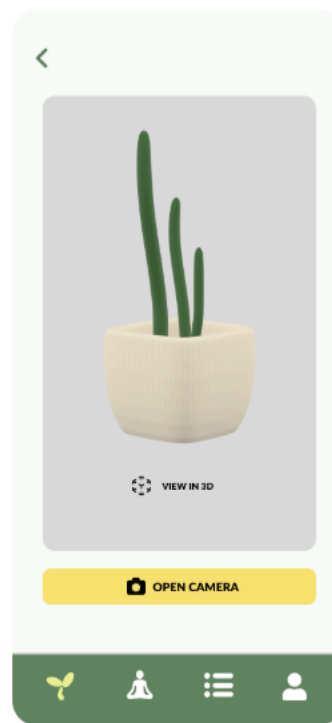
Meditation Timer

According to user feedback, users can effortlessly adjust the meditation duration in this app by sliding the meditation duration in this app by sliding the slider, eliminating the need for tedious manual time input.



AR Plant

The AR feature allows users to view their virtual plant superimposed in their physical surroundings through their device's camera, bridging the digital and physical realms.



REALIZATION PLAN

Development Methodology: We will follow an Agile development methodology, such as the Scrum framework, which allows for iterative development, regular feedback loops, and the ability to adapt to changes or new requirements.

Technology Stack: Our application could be developed using React Native, a cross-platform framework for building native mobile apps. For the backend, we will try to use Node.js with Express for the server and MongoDB for the database if necessary. The Augmented Reality (AR) functionality will be implemented using ARCore for Android and ARKit for iOS.

Backend Infrastructure: The application will utilize a cloud-based backend infrastructure. We could deploy the Node.js server and MongoDB database on a cloud platform. This will ensure scalability, reliability, and ease of maintenance. User data, plant information, and personalized settings will be securely stored in the MongoDB database.

User Interface and User Experience Implementation: The design mockups and prototypes will be translated into a responsive and visually appealing user interface using React Native's built-in components and styling mechanisms. We will leverage the React Navigation library for seamless navigation between different screens and features. The UI could be designed to adhere to platform-specific design guidelines (Material Design for Android and Human Interface Guidelines for iOS).

Testing and Quality Assurance: We will implement a comprehensive testing strategy, including:

- Unit testing using Jest for individual components and functions
- Integration testing using tools like Detox or Appium for end-to-end testing of the entire application
- Continuous Integration (CI) and Continuous Deployment (CD) pipelines for automated testing and deployment
- Regular user acceptance testing sessions with a representative sample of the target audience

Deployment and Release Management: The application will be released on both the Google Play Store for Android and the App Store for iOS. We will follow the respective platform guidelines for submission and approval processes. A staged rollout approach will be adopted, starting with a limited release to gather feedback and iron out any issues before a wider release. Versioning and release notes will be maintained, and over-the-air updates will be supported for seamless upgrades.

Security and Privacy Considerations: User data privacy and security will be of utmost importance. We will implement industry-standard encryption techniques for data at rest and in transit. Authentication and authorization mechanisms will be put in place to ensure secure access to user accounts and data. The application will comply with relevant privacy regulations, such as GDPR and CCPA.

Maintenance and Support: After the initial release, we will have a dedicated team for ongoing maintenance, bug fixes, and feature enhancements. A support system, including in-app feedback mechanisms, email support, and community forums, will be established to address user issues and gather feedback for future improvements.

By following this realization plan, we want to deliver a high-quality, secure, and user-friendly Plant Care and Mental Health mobile application that meets the requirements and provides an engaging experience for users.

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Lee, Min-sun, Juyoung Lee, Bum-Jin Park, and Yoshifumi Miyazaki. 2015. “Interaction with Indoor Plants May Reduce Psychological and Physiological Stress by Suppressing Autonomic Nervous System Activity in Young Adults: A Randomized Crossover Study.” *Journal of Physiological Anthropology* 34 (1): 21. <https://doi.org/10.1186/s40101-015-0060-8>.

MORE INFO

Link to the final design video:

https://drive.google.com/file/d/1HHMO8d8dzKhMsAm5NoRkLzdt7rG_cQvm/view?usp=sharing

Link to the Figma final prototype (Interactive through a certain user path):

<https://www.figma.com/proto/Z2WKBkrtUeHpYQqGmbDQCN?page-id=0%3A1&type=design&node-id=67-356&t=jbvIXLc8aQoHrOiS-0&scaling=scale-down&starting-point-node-id=67%3A356>

Link to the Figma file:

<https://www.figma.com/file/Z2WKBkrtUeHpYQqGmbDQCN/User-flow?type=design&node-id=0%3A1&mode=design&t=tmtPK7FNZNa8H9ld-1>