

# WildLoop

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An outdoor exploration app for nature enthusiasts

*Explore. Discover. Reconnect with nature.*

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UX Case Study · Lean UX Process · Research to Hi-fi Prototype

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## Abstract

This project explores the design of a mobile application that integrates outdoor navigation with nature-based learning to address the growing need for tools that support both physical activity and ecological engagement. While outdoor apps commonly focus on route planning and fitness tracking, few offer meaningful interaction with biodiversity or location-based educational content. Grounded in Lean UX methodology, the project followed iterative cycles of research, prototyping, and user testing. Key methods included literature review, stakeholder interviews, persona development, and usability testing with mid-fidelity prototypes. The resulting design enables users to explore custom trails based on species distribution and engage with gamified species identification. Two primary user groups were identified: physically active individuals seeking deeper nature connection, and digitally engaged users motivated by informal environmental learning. The final prototype demonstrates how lightweight, optional educational content can be embedded within outdoor routines without interrupting the activity flow. The app aims to promote nature connectedness and sustainable awareness through a flexible, user-centred experience. Future development opportunities include enhancing community features, expanding environmental datasets, and tailoring activity summaries by movement type. This project highlights the value of integrating behavioural and educational goals into digital outdoor tools to foster meaningful, scalable, and inclusive engagement with nature.

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# 1. Introduction

## 1.1. Introduction

In recent years, outdoor participation has surged, reflecting growing interest in nature-based recreation (Outdoor Industry Association, 2023). Specifically, outdoor activity involvement climbed to a record 168.1 million participants in 2022, encompassing roughly 55% of Americans aged six and older. This trend underscores a meaningful opportunity to enhance mobile tools that support not just routing but also deeper engagement with the environment. This trend presents a valuable opportunity to enhance mobile tools that support not only route navigation but also more meaningful interactions with the natural world.

However, most outdoor planning tools focus on route navigation and basic weather updates while providing limited ecological insight along the way, which leaves a gap for users who want to understand and appreciate the ecosystems they encounter. Biodiversity learning is often siloed from navigation. Meanwhile, informal, place-based nature education remains underused in everyday outdoor experiences, despite evidence that place-tied learning fosters curiosity and deeper engagement (Ellington and Prado, 2024).

This project addresses these gaps by designing a mobile application that integrates personalised route planning, real-time environmental context, and place-based biodiversity insights. By combining navigation and learning into a unified experience, the app aims to enrich outdoor activities, promote mindful exploration, and support a deeper emotional connection to the environment.

## 1.2. Background

### (1) Urban Lifestyle and Limited Nature Access

Modern urban living often restricts regular contact with natural environments; nonetheless, outdoor participation continues to grow (Outdoor Industry Association, 2023), indicating unmet needs for tools that connect everyday recreation with local nature. Compared to rural populations, urban residents typically have fewer opportunities for direct interaction with nature, leading to lower ecological knowledge and weaker emotional bonds with the natural world, undermines pro-environmental attitudes and behaviours, as well as individuals' capacity to care for and benefit from nature (Bashan, Colléony and Shwartz, 2021). This highlights the need for accessible, nature-connected tools that can help urban residents rebuild emotional and ecological ties with the natural environment.

## **(2) Current Outdoor Tools Focus on Navigation Rather than Ecological**

### **Engagement**

Most digital outdoor tools are designed to assist users with navigation, route planning, and physical activity tracking. While these features improve safety and accessibility, they rarely incorporate biodiversity context or support route-based ecological learning, leaving such content fragmented across separate apps (Roddie, 2024). Furthermore, they seldom encourage reflection on ecological systems or promote environmentally responsible behavior. Research indicates that outdoor recreation alone does not automatically foster ecological awareness or pro-environmental action unless it is supported by intentional education and reflection on human–nature relationships (Høyem, 2020). Therefore, integrating ecological content into outdoor activity apps presents an opportunity to strengthen users' connection with nature and promote more sustainable behaviors.

## **(3) Growing Interest in Combining Outdoor Recreation with Nature Education**

Place-based outdoor learning has been shown to enhance engagement and strengthen individuals' attachment to the places they explore. This highlights the value of delivering short, context-aware insights that align with users' movement through natural environments (Ellington and Prado, 2024). Citizen science platforms also demonstrate that lightweight species discovery can effectively motivate participation while contributing meaningful biodiversity data. This approach can be translated into route-based micro-learning within digital applications (Mason et al., 2025). Furthermore, research shows that longer-term, residential, or repeated outdoor learning experiences tend to produce more lasting and meaningful outcomes compared to short-term, one-off field trips (Braun and Dierkes, 2016). These findings underscore the potential of integrating outdoor recreation with continuous nature education to support deeper environmental connection and learning.

## **(4) Gaps and Potential for Integrated, Educational Outdoor Tools**

Despite the growing interest in both outdoor recreation and environmental education, existing tools rarely offer a unified experience that supports real-time environmental awareness and biodiversity learning. Features such as air quality, UV levels, or soil moisture are often presented in isolation and lack connection to users' immediate context or movement patterns. Similarly, nature education content is typically delivered separately from activity-based platforms, limiting its relevance and accessibility during outdoor experiences. These gaps suggest a strong potential for an integrated system that combines route planning with live environmental data and location-specific ecological insights, enabling more meaningful and informed interactions with natural spaces..

## **(5) Social and Economic Trends**

There is a growing social emphasis on the sustainability, equity, and inclusivity of outdoor education. Increasingly, programmes are designed to promote environmental stewardship, community engagement, and social capital. These developments reflect broader concerns about ecological degradation and social inequality (Hu and Mou, 2025). At the same time, outdoor learning is widely recognised for its contributions to mental health, social skills, and identity development, which drives demand for tools that support holistic well-being (Mann et al., 2022).

From an economic perspective, urbanisation and population growth continue to intensify, particularly around metropolitan centres, leading to rising demand for accessible and meaningful nature-based experiences. Shifting cultural values and lifestyle patterns have contributed to growing public interest in informal environmental learning. However, access to nature and participation in outdoor activities remain uneven across different demographic and geographic groups (Winter et al., 2019). Nature-based engagement is also associated with broader economic benefits including talent attraction, youth retention, climate resilience, and local economic development. Community-driven models that integrate outdoor recreation, conservation, and economic planning are increasingly recognised for their potential to deliver multiple benefits and strengthen local resilience (Rogers et al., 2024).

Together, these social and economic dynamics highlight an urgent need for inclusive, educational tools that connect diverse user groups with local environments in equitable and sustainable ways.

### 1.3. Aims and Objectives

To design a mobile application that enhances user engagement with the natural environment by integrating biodiversity recognition, personalised route planning, and reflective activity tracking. The app seeks to promote environmental awareness, curiosity, and a deeper connection to nature through interactive, educational, and emotionally engaging experiences.

**To achieve this aim, the project sets out to:**

- (1) Conduct user research with at least five target users within one week to understand their motivations, habits, and challenges in outdoor nature engagement and biodiversity learning.
- (2) Analyse a minimum of five existing applications related to outdoor navigation and nature education to identify functional gaps and inspiration for feature development.
- (3) Develop at least three low-fidelity prototypes within ten days to explore diverse interaction models for plant and animal recognition, personalised route generation, and exploration tracking.
- (4) Build a mid- to high-fidelity interactive prototype within one week, incorporating key features such as map-based exploration, image-based species recognition, and achievement tracking.
- (5) Conduct usability testing with at least five participants within one week to evaluate ease of use, task efficiency, emotional engagement, and educational impact.
- (6) Iterate the design based on test findings within two weeks, aiming to address at least 80% of identified usability or experience issues.
- (7) Assess the impact of the final prototype on user engagement and nature-related motivation through short post-test questionnaires and qualitative interviews.
- (8) Produce a final academic report within one week after evaluation, documenting the full design process, user insights, tested assumptions, and reflections.
- (9) Deliver a final project presentation within one week after report submission, clearly communicating research findings, design outcomes, and future opportunities.

## 1.4. Method

Lean UX is a design approach that emphasizes rapid experimentation, cross-functional collaboration, and continuous feedback to build user-centered solutions efficiently. Unlike traditional UX methods, Lean UX focuses less on detailed deliverables and more on iterative learning through lightweight artifacts and early testing (Gothelf and Seiden, 2013).

In this project, Lean UX was selected instead of alternative methods such as Design Thinking due to its practical advantages in a fast-paced and hypothesis-driven context. Design Thinking typically follows a five-stage process: Empathize, Define, Ideate, Prototype, and Test. While this framework is effective for exploring complex problems and generating human-centered ideas, it can become time-consuming and heavily reliant on polished deliverables, which may delay actionable design decisions (Brown, 2009).

In contrast, Lean UX encourages quick experimentation, minimal upfront documentation, and continuous feedback, making it more aligned with the needs of this project. This project involved designing a mobile application that integrates outdoor navigation with nature-based learning, a context that requires continuous refinement based on user behavior, motivation, and situational use. Lean UX was particularly appropriate as it supports hypothesis-driven design and rapid iteration, allowing the team to quickly test assumptions about how users engage with activities such as ecological map exploration, species recognition, and personalised route planning. These functions benefit from immediate feedback to optimise usability. Moreover, given the project's limited time and resources, Lean UX enabled the development of minimum viable features that delivered early user value while avoiding unnecessary investment in unvalidated ideas.

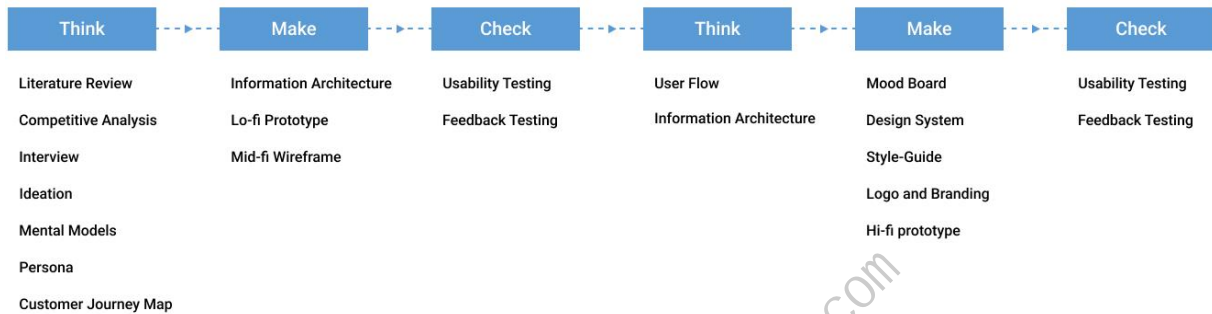
The Lean UX process adopted in this project followed a cyclical structure of Think, Make, and Check. During the Think stages, initial research activities such as literature review, competitive analysis, user interviews, and persona development were conducted to establish foundational insights and inform design hypotheses. In the Make stages, both low-fidelity and mid-fidelity prototypes were created, supported by structured information architecture. The Check stages involved usability testing and feedback evaluation, which provided evidence for refining and validating core features.

This iterative and lightweight approach enabled the team to rapidly test key interactions, such as map navigation, species logging, and custom trail building. Through multiple rounds of prototyping and validation, Lean UX supported the

development of a solution that directly responded to user behavior and evolving needs, ensuring that design decisions were grounded in evidence rather than assumptions.

A high-resolution version is available at the following link:

[https://kingstonuniversity-my.sharepoint.com/:i:/g/personal/k2438742\\_kingston\\_ac\\_uk/Ecvs84ukquBCiaBDm\\_FaX5wBwPkJGq0WmSJ9KXRYmCgkw?e=R0JYJX](https://kingstonuniversity-my.sharepoint.com/:i:/g/personal/k2438742_kingston_ac_uk/Ecvs84ukquBCiaBDm_FaX5wBwPkJGq0WmSJ9KXRYmCgkw?e=R0JYJX)



**Figure 1. Design Process**

## 2. Think

### 2.1. Literature Review

#### (1) Outdoor Activities and Nature Connectedness

In recent years, increasing attention has been paid to the psychological and emotional impacts of nature contact in both urban and natural settings. While outdoor activities have long been associated with physical health benefits, emerging research emphasizes the distinct and measurable effects of nature connectedness, a psychological construct reflecting one's emotional relationship with the natural world, on individual well-being. This section explores how engaging with outdoor environments supports mental health, and how strengthening emotional ties to nature can deepen these benefits.

A growing body of research highlights the positive impact of nature connectedness on mental health and emotional well-being. Spending time in natural environments has been shown to reduce stress and enhance emotional resilience (Vittery et al., 2025). Regular exposure to natural elements, whether through physical visits or nature-based media, has also been linked to improved psychological outcomes and increased pro-environmental behaviours (Martin et al., 2020).

A systematic review of 46 studies concluded that urban green spaces are the primary pillar for a sustainable urban environment and human well-being, due to their consistent associations with physical, psychological, and social health benefits (Jabbar, Yusoff and Shafie, 2021). Large-scale survey data from Australia support this finding, indicating that individuals experience greater reductions in stress and anxiety from frequent visits to green spaces, with those who report higher levels of nature connectedness benefiting more significantly than those with weaker emotional ties to the natural world (Chang et al., 2024).

Among older adults in Canada, living near trees and reporting a strong connection to local nature correlated with better self-rated mental health, more positive mood, and lower psychological distress, even when controlling for variables such as age, income, and neighbourhood context (Nisbet et al., 2020). Similarly, Liu et al. (2022) conducted a survey of 863 urban adults and found that nature connectedness was a stronger predictor of positive mental well-being such as life satisfaction and meaningfulness than nature exposure alone. Higher nature connectedness was linked to approximately 7 percent higher life worthwhileness, 6 percent higher life satisfaction, and 2.5 percent lower depression risk.

Collectively, these studies demonstrate that nature connectedness plays a critical role in enhancing mental well-being across diverse populations. Individuals who feel emotionally bonded to nature tend to derive deeper psychological benefits from green space interactions. This suggests that interventions aiming to strengthen a user's psychological connection to nature may have more lasting mental health effects than those focusing solely on increasing physical exposure to outdoor environments.

## **(2) Environmental Data and Outdoor Experience**

As individuals increasingly engage with natural environments, the quality and composition of outdoor settings have become critical factors influencing user comfort and emotional connection. Beyond basic navigation and weather information, environmental data can offer valuable insights into how users perceive and interact with green spaces. Integrating such data into outdoor experience design can help foster both psychological engagement and sustained use.

Environmental features such as vegetation density and tree canopy have been linked to stronger emotional ties with nature. A study found that individuals living in areas with higher tree coverage tend to report greater nature connectedness, particularly in relation to wildlife and local ecosystems. While canopy density did not significantly increase overall time spent outdoors, it was associated with more frequent use of private gardens, indicating that exposure to biodiverse surroundings can foster psychological connection even in passive contexts (Nisbet et al., 2020).

Thermal and acoustic comfort also shape users' experience in public green spaces. Research based on crowdsourced reviews from urban parks in New York City revealed that shading was particularly effective in reducing heat-related discomfort. Acoustic factors, such as noise level, were also found to influence satisfaction with outdoor environments. These findings suggest that environmental variables like temperature, light, and sound should be considered in outdoor planning and digital route design to improve perceived comfort and encourage frequent engagement (Cureau et al., 2024).

In addition to ecological quality, aesthetic value plays an important role in outdoor engagement. A large-scale study analyzing over 200,000 geotagged photographs from the United Kingdom demonstrated that scenic beauty is influenced by both natural and built features. Coastal areas, mountains, and forests were associated with high scenic ratings, while elements such as towers and castles also enhanced perceived attractiveness. In contrast, uniform green areas such as grass fields were rated less positively. This suggests that outdoor environments with visual diversity

and cultural landmarks may enhance users' appreciation of nature (Seresinhe et al., 2017).

Overall, effective outdoor experience design should take into account a broad range of environmental factors. In addition to temperature and UV exposure, elements such as tree density, shading, acoustic conditions, and scenic diversity contribute to both physical comfort and emotional connection. Incorporating these factors can help create more meaningful and engaging nature-based experiences.

### **(3) Biodiversity and Place-Based Learning**

Place-based nature education plays a significant role in fostering both cognitive development and emotional connection to the environment. Research consistently highlights that direct, immersive experiences in natural settings enhance learning outcomes, emotional well-being, and a sense of environmental stewardship.

A growing body of evidence demonstrates that contact with nature can improve various aspects of cognitive and emotional functioning. Short-term passive exposure to nearby green environments has been associated with cognitive benefits, particularly in restoring attention and reducing mental fatigue. A systematic review of 14 studies found that brief interactions with nature lasting from 10 to 90 minutes significantly enhanced students' cognitive performance (Mason et al., 2021). Similarly, another review highlights that exposure to natural environments helps reduce stress and cognitive overload, thereby supporting improved attention and mental recovery (Nanda et al., 2023). Beyond these cognitive outcomes, strengthening individuals' psychological connection to nature has also been linked to enhanced social-emotional competencies, including self-awareness, self-management, and relationship skills. These findings support the potential of nature-based interventions in promoting holistic personal development (Lanza et al., 2023).

In addition to cognitive and emotional gains, place-based learning also contributes to the development of environmental awareness and responsibility. Structured nature connection activities such as journaling, solo wandering, and storytelling have been shown to cultivate deeper relationships with the natural world, reinforcing an understanding of human and ecological interdependence (Brindal, 2023). This type of education further supports collective wellbeing and eco-social transformation by fostering relational belonging and building nature-connected learning communities (Roze des Ordons and Hill, 2024). Emotional connectedness to nature has also been found to significantly increase environmental commitment by enhancing individuals' social identity and environmental concern, both of which play mediating roles in promoting pro-environmental behavior (Yu et al., 2019).

Overall, the integration of place-based nature education into everyday experiences offers substantial benefits for cognitive growth, emotional resilience, and environmental responsibility. By improving both personal development and ecological consciousness, such approaches encourage sustained engagement with nature and foster more sustainable behaviors over time.

#### **(4) Technology for Environmental Engagement**

Technology plays an increasingly important role in shaping how individuals interact with the environment. In recent years, a range of digital tools and interactive applications has emerged to support users in visualising environmental data, understanding ecological processes, and building more meaningful relationships with the natural world. By translating complex or otherwise invisible ecological signals into accessible and emotionally engaging formats, digital technologies have the potential to promote environmental awareness, encourage pro-environmental behaviour, and support informal environmental learning across diverse contexts.

Building on these opportunities, technologies such as mobile applications, virtual and augmented reality, and online communication platforms have enabled users to document, analyse, and share their environmental experiences. These tools facilitate both formal and informal learning within schools, households, and communities. Research in experiential environmental education suggests that digital platforms can enhance interest in sustainability, particularly through participatory initiatives such as citizen science projects (Buchanan, Pressick-Kilborn and Maher, 2018). Moreover, a recent quasi-experimental study has shown that the integration of active digital learning strategies, including online discussions and collaborative tasks, significantly improved students' critical thinking, autonomy, and sense of civic responsibility. These findings indicate that well-designed technology-enhanced learning environments can effectively support long-term environmental awareness and motivation for sustainable action (Zahra et al., 2024).

Recent scholarship also points to the need for critical evaluation of digital tools within environmental engagement processes. Digital technologies may improve accessibility and participation, yet they also introduce new challenges related to inclusivity, ethical considerations, and the credibility of interaction. As traditional engagement frameworks are applied in digital settings, factors such as social trust and contextual relevance require reinterpretation. These insights are essential for the development of digital tools that foster meaningful and context-sensitive decision-making processes (Hafferty et al., 2024).

Although digital technologies offer considerable promise, they remain subject to several limitations. Educational software often fails to meet the pedagogical demands of sustainability education and is frequently under-theorised (Greenhow and Lewin, 2016; Vogel et al., 2014). Virtual environmental interactions, while informative, may result in fragmented or superficial learning when compared to direct experiences with nature, which have been shown to more effectively influence environmental attitudes and values (Schönfelder and Bogner, 2017; Buchanan, Pressick-Kilborn and Maher, 2018). Nevertheless, when carefully implemented, digital tools can serve as valuable platforms for supporting environmental literacy, facilitating student agency, and broadening participation in sustainability discourse.

### **(5) Gamification and Motivation in Outdoor Apps**

Gamification has emerged as a valuable strategy for promoting physical activity and outdoor engagement through mobile applications. By integrating game elements such as rewards, progress tracking, and social features, these apps aim to enhance user motivation and support long-term behavioural change.

Recent research indicates that gamified sports apps can effectively satisfy users' psychological needs for autonomy, competence, and relatedness, particularly through achievement- and immersion-related game elements. These needs, in turn, positively influence autonomous motivation, with autonomy and relatedness showing the strongest effects. However, prolonged app use may reduce motivational outcomes over time, suggesting that sustaining engagement requires dynamic and adaptive design strategies (Bitrián, Buil and Catalán, 2020).

Further evidence suggests that gamification features in health and fitness apps can engage previously inactive individuals by aligning with personal goals such as improving fitness, increasing outdoor activity, and adopting a more active lifestyle. Rather than being influenced by personality traits, users' interest in app features is shaped by how relevant these features are to their intended outcomes. Functionalities that enhance perceived competence, such as feedback, instructional content, and reward systems, have been shown to support both intrinsic and extrinsic motivation for sustained participation (Meixner, Baumann and Wollesen, 2020).

In summary, gamification in outdoor-related apps holds strong potential to promote motivation and behavioural change by supporting users' psychological needs and aligning app design with personal goals. Future developments should focus on tailoring experiences to maintain long-term user engagement and maximise the benefits of gamified interventions.

## **(6) Design Gaps and Opportunities**

As interest in nature-based education continues to grow, various tools and programs have been developed to support outdoor learning and environmental engagement. However, despite the wide range of existing resources, there remains a significant gap in the availability of integrated products that combine outdoor exploration with structured, self-directed educational content. Understanding this gap is essential for designing more inclusive and effective learning tools that bridge digital and physical experiences in natural settings.

A number of schools and educational institutions have introduced outdoor classrooms and residential programs that encourage nature connection, imaginative play, and ecological responsibility (Mullenbach, Andrejewski and Mowen, 2018; Braun and Dierkes, 2016). These approaches are often rooted in local contexts and heavily rely on place-based, teacher-led learning, rather than product-driven engagement. In the consumer market, tools such as field guides, nature-themed toys, and augmented reality games like Pokémon GO have been shown to stimulate outdoor activity and discovery (Yu, 2025). However, such products typically lack integration with structured curricula or educational objectives. Although some digital toolkits and mobile apps support outdoor science exploration by combining technology with hands-on activities, they are often limited in scope, loosely connected to educational standards, or not widely adopted for systematic nature education (Karno and Fish, 2021).

Despite growing interest from educators, families, and learners in nature-focused exploration, there is little evidence of comprehensive, user-friendly products that effectively merge outdoor discovery with interactive and meaningful learning content. Studies have shown that many existing tools fall short in supporting observation, identification, and interpretation in diverse outdoor environments (Zimmerman and McClain, 2014; Kawas et al., 2021). While a few mobile apps provide species recognition or environmental data, these often focus on isolated features and do not offer cohesive learning experiences. Moreover, most current solutions lack adaptability across age groups and learning contexts, making it difficult for users to engage with nature independently or at their own pace (Goldstein et al., 2019).

In summary, there is a clear gap in the market for a product that integrates outdoor navigation with structured, self-guided nature education. Existing solutions tend to either promote physical exploration without educational support, or deliver environmental content without facilitating real-world interaction. A product that successfully combines these two aspects, encouraging users to explore natural settings while simultaneously supporting observation, learning, and reflection, would

represent a valuable contribution to the fields of environmental education and digital engagement.

## **2.2. Target Audience**

Based on insights from the literature, this project primarily targets two user groups. The first group includes physically active individuals who already engage in outdoor activities, such as walking, hiking, or cycling, but may lack a deeper awareness of the natural environment. These users are often motivated by health and lifestyle goals. Research suggests that features which enhance perceived competence, such as instructional content, personalised feedback, and reward systems, can effectively sustain motivation and encourage continued participation (Meixner, Baumann and Wollesen, 2020). By embedding lightweight nature education into their existing routines, the app aims to gently foster environmental curiosity and emotional connection without disrupting activity flow.

The second group consists of users who express an interest in learning about nature but may currently engage with it primarily through digital means. While virtual interactions can provide accessible environmental information, they are often associated with fragmented or superficial learning. In contrast, direct experiences with nature have been shown to more effectively shape environmental attitudes and values (Schönfelder and Bogner, 2017; Buchanan, Pressick-Kilborn and Maher, 2018). For this group, the app provides a bridge from passive digital consumption to active, embodied learning in natural spaces, supporting more meaningful engagement with biodiversity and place-based discovery.

Together, these two groups represent users who are either motivated by activity or by curiosity. Designing for both enables the app to promote nature connectedness through both behavioural and educational pathways, aligning with the broader goals of environmental awareness and sustainable well-being.

### 2.3. Competitive Analysis

To inform the design direction and identify opportunities for innovation, a competitive analysis was conducted on a range of existing applications related to outdoor activity planning, environmental awareness, and nature-based education. The selected products were categorised into three functional groups: outdoor activity apps, environmental data tools, and nature education platforms. Each product was evaluated based on its core functionality and key features, including navigation capabilities, data integration, educational interactivity, and user engagement strategies. This analysis provided valuable insights into current market offerings, highlighting both best practices and design gaps that informed the development of the proposed solution.

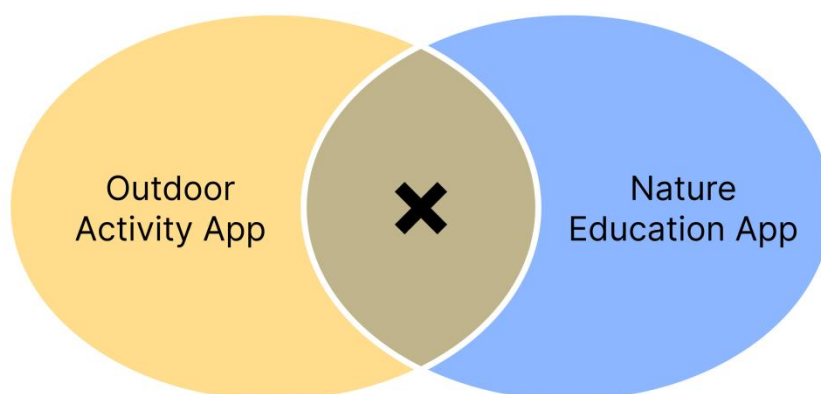
Product	Function	Features
<b>Outdoor Activity App</b>		
Strava	Tracks and plans outdoor activities	Social activity sharing, custom route builder, AI "Suggested Routes" tailored by location and terrain
AllTrails	Offers hiking trail selection and navigation	More than 450k trail database, reviews & photos
Komoot	Route planning for hiking/cycling	Custom route creation, surface type breakdown, terrain visualization, integrates OpenStreetMap
Google Maps	Provides real-time GPS navigation, route planning, and map-based exploration	Turn-by-turn navigation, satellite view, location search, nearby nature spots, AR direction
<b>Nature Education App</b>		
Merlin	Identifies bird species via camera input	AI bird recognition, region-specific "bird packs"
PeekVisor	Identifies mountain peaks via AR	AR overlay naming peaks and elevations, works offline
iNaturalist	Species identification and citizen science	Crowd-sourced biodiversity observations, automated species recognition, gamified badge collection
Biodiversa	Gamified species identification and learning	Snap species image to unlock info, machine learning recognition

**Table 1.** Competitive Analysis Table

While current applications in the domains of outdoor activity and nature education offer robust functionalities, several critical gaps remain unaddressed. Many route planning apps such as Strava, AllTrails, and Komoot excel at supporting physical exploration and navigation but lack integration with biodiversity education or contextual environmental awareness. Conversely, educational apps like Merlin, iNaturalist, and Biodiversa provide detailed species recognition and learning tools, yet they operate largely in isolation from the broader outdoor experience, offering limited support for route-based exploration or real-time activity tracking.

The proposed solution aims to bridge this gap by combining the spatial navigation strength of outdoor apps with the contextual richness and interactivity of nature education tools. Unlike existing platforms, it introduces personalised route generation based on ecological interests, in-activity biodiversity tracking, and reflective summaries that encourage environmental learning. These features go beyond current offerings by integrating exploration, education, and engagement in a single cohesive user experience.

Through competitive analysis, several valuable features were identified across existing platforms, including the intuitive map-based navigation of Google Maps, the custom route builder in Komoot, and the gamified learning mechanisms of Biodiversa. However, many apps demonstrate limitations in onboarding support, accessibility, or relevance to younger users and casual explorers. These insights inform the design priorities of the proposed prototype, which emphasizes a smooth onboarding experience, clarity in interaction flow, and a holistic learning journey grounded in real-world engagement. To further articulate the identified opportunity, the following diagram illustrates the conceptual gap between outdoor activity applications and nature education tools. The proposed solution is positioned at this intersection, aiming to deliver an integrated experience that supports both physical exploration and environmental learning.



**Figure 2.** Identified Market Gap Between Outdoor Activity and Nature Education Apps

## 2.4. Interview

### (1) Protocol

#### - Participants:

- 1) Inclusion Criteria
  - Aged 18-40 years old
  - Enjoy outdoor activities such as hiking, walking, running, or cycling
  - Have an interest in nature, local environments
  - Regularly use a smartphone for maps, fitness tracking, or navigation apps
  - Reside in an urban or suburban area and actively seek opportunities to access green spaces
  - Comfortable using mobile apps and reading basic environmental data
- 2) Exclusion Criteria
  - Rarely engage in outdoor activities or have no interest in topics
  - Professional background in environmental science, landscape architecture, or UX design
  - Current participation in similar nature-connectedness studies
  - Severe sensory impairments that would prevent interaction with the app's core visual features.

#### - Meeting Details:

- 1) Data Collection Period: August 01-10, 2025
- 2) Session Duration: Approximately 30 minutes
- 3) Platform: Microsoft Teams or offline (recorded with consent)

### (2) Summary

#### - Outdoor Activity Habits:

- 1) Types: Walking, fitness, cycling, hiking (short & long trips), occasional camping or visits to suburban/mountain areas.
- 2) Frequency: Walking and park visits are frequent (daily/weekly); long hikes occur a few times a year.
- 3) Place Selection: Urban parks, riversides, outskirts, mountains; information sources include Google, social media (Instagram Reels, YouTube), and friends' recommendations.

#### - Environmental Data of Interest:

- 1) Most frequently checked: Weather, temperature, rainfall.
- 2) Secondary but of interest: Wind speed/direction, UV index, air quality (AQI).
- 3) Currently missing / desired data:
  - Soil moisture (to avoid mud or slippery terrain)
  - Local flora and fauna information (identification, avoiding dangerous species)

- Route recommendations (based on weather and ground conditions)
- Crowdedness level
- 4) Data sources: Weather apps (Google Weather), maps (Google Maps), and social media experience sharing.
- **Attitude Toward Nature Education:**
  - 1) Strong interest in local flora and fauna knowledge, especially rare or unique species.
  - 2) Preference for short, engaging content (2–3 sentences + image/map marker).
  - 3) Desire to integrate information with routes, e.g., map annotations or “discovery tasks” during the activity.
  - 4) Sharing motivation exists; reward mechanisms (even digital badges) could encourage more active participation.
- **Interaction Preferences:**
  - 1) Preferred formats:
    - Map markers (icons)
    - Gamified challenges (find specific plants/animals)
    - Short text + image
  - 2) Preferred timing:
    - Before the activity: Safety and preparation info (weather, animal risks)
    - During the activity: Map-based tasks, instant reminders
    - After the activity: Summary report (route taken, species encountered)
  - 3) Dislikes: Long, irrelevant, or cluttered content lists.

### (3) Insights

1. Outdoor activity planning is still largely driven by weather and location, but there is a clear demand for more specific nature-related data such as ground conditions and species information, which is not well supported by current tools like AllTrails.
2. Nature education content is most effective when directly tied to specific routes or locations and presented through map markers or interactive tasks; otherwise, it is often ignored.
3. The concept of collecting digital cards of plants and animals spotted during activities was considered engaging and motivating. Users suggested displaying these collections in the profile in a Pokémon-style format to encourage continued exploration.
4. Lightweight content delivery, such as two to three sentences with visuals or icons, is preferred, as long-form information tends to reduce interest.
5. Combining safety-related environmental data (weather, animal risks, soil moisture) with interest-driven nature data (unique flora, fauna, scenic points) can address both practical and recreational needs.

## 2.5. Problem Statement

Current outdoor activity products cover only parts of what nature-oriented users need. Route planning and fitness apps provide trails, navigation, and basic environmental data such as temperature, precipitation, wind and sometimes UV. Identification apps recognise plants and animals and offer standalone facts, yet they are not embedded in the planning or execution of a route. There is no widely used tool that integrates route planning with on-route species identification and place-based ecological context.

For outdoor enthusiasts who care about nature, this fragmentation leads to two gaps. First, decisions about where and when to go are made without key ecological cues such as soil moisture and ground conditions, which affect safety and comfort on paths and lawns. Second, opportunities to notice and learn about local biodiversity arise by chance rather than through timely, location-aware prompts.

A solution is needed that unifies route planning, real-time environmental signals including soil moisture, and in-situ species discovery and education. By delivering concise, context-aware guidance before and during activities, such a tool can help nature-loving users plan better outings, explore more meaningfully, and build a deeper connection with nearby ecosystems.

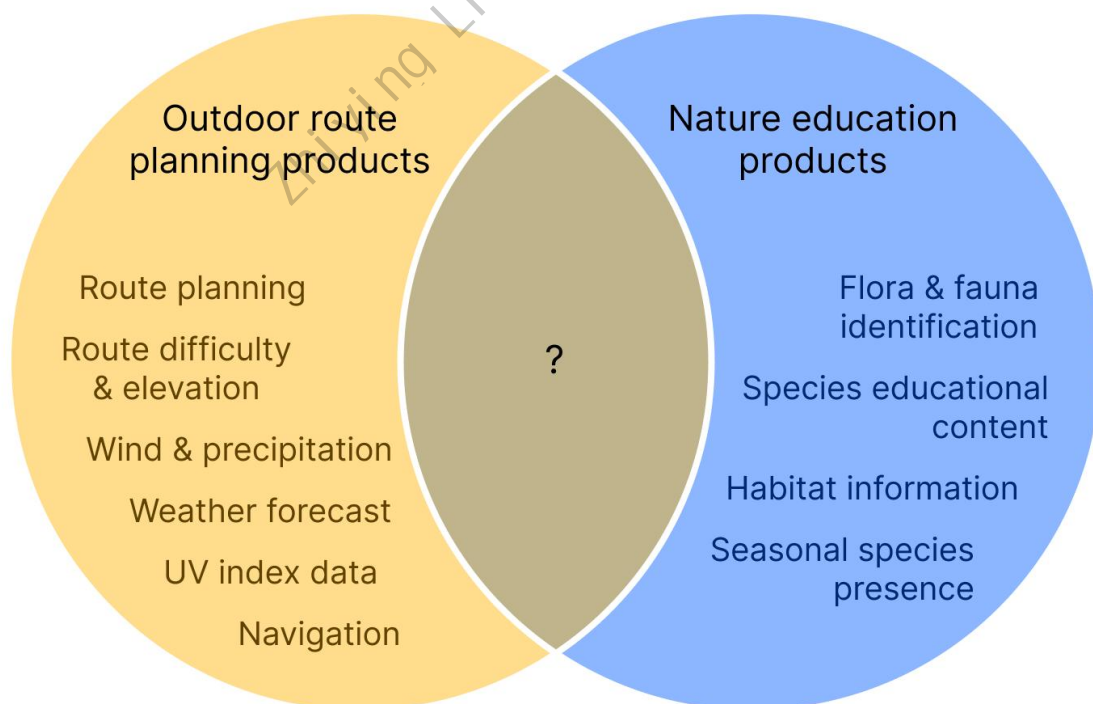


Figure 3. Problem Statement

## 2.6. Early Lean UX Canvas

The Early Lean UX Canvas for this project identifies a clear gap in the current market. While many existing tools provide route planning or basic environmental data, few integrate these features with real-time biodiversity education. This results in missed opportunities to have richer, safer, and more educational nature experiences.

The primary users are nature-loving explorers who value environmental awareness and comfort during their activities. The desired business outcome is to create a differentiated product that increases engagement with local ecosystems while supporting informed and safe outdoor decision-making.

From the user's perspective, the benefits include deeper emotional connection with nature, improved knowledge of local flora and fauna, and personalised route and clothing recommendations based on real-time environmental conditions. The proposed solution is a mobile application that seamlessly combines route planning, live environmental monitoring, and in-route biodiversity insights.

A high-resolution version is available at the following link:

[https://kingstonuniversity-my.sharepoint.com/:i/g/person/k2438742\\_kingston\\_ac\\_uk/Eb\\_vaM1R0rVGov96XXFV7UsB2T8VG2oatwYvaoQjdNueoA?e=CQfKhw](https://kingstonuniversity-my.sharepoint.com/:i/g/person/k2438742_kingston_ac_uk/Eb_vaM1R0rVGov96XXFV7UsB2T8VG2oatwYvaoQjdNueoA?e=CQfKhw)

Early Lean UX Canvas		
<p><b>Business Problem</b></p> <p>Urban and suburban outdoor enthusiasts lack an integrated tool that combines route planning, real-time environmental data, and in-route biodiversity education. Existing products offer these features separately, resulting in missed opportunities for richer, safer, and more meaningful nature experiences.</p>	<p><b>Solutions</b></p> <ol style="list-style-type: none"> <li>1. Easily plan outdoor routes with the most suitable environmental conditions to ensure safety and comfort.</li> <li>2. Receive smart recommendations for the best route and appropriate clothing based on current weather and environmental data.</li> <li>3. Learn about local plant and animal species seamlessly during their activities, without switching between multiple apps.</li> <li>4. Gain a deeper emotional connection with the natural environment while actively engaging with it.</li> <li>5. Expand personal knowledge of local ecosystems and biodiversity, turning outdoor activities into educational opportunities.</li> </ol>	<p><b>Business Outcomes</b></p> <ol style="list-style-type: none"> <li>1. Validate whether design improves user engagement and satisfaction in outdoor activities</li> <li>2. Identify how real-time environmental data influences outdoor decision-making and perceived safety</li> <li>3. Evaluate if the app increases users' awareness and curiosity about local biodiversity</li> <li>4. Gather qualitative insights into how combining exploration and education changes emotional connection with nature</li> <li>5. Produce usability test results to inform future design iterations and academic discussion</li> </ol>
<p><b>Users</b></p> <ol style="list-style-type: none"> <li>1. Nature-loving hikers, runners, and cyclists</li> <li>2. Casual weekend explorers who want to learn about local flora and fauna</li> <li>3. Campers who value environmental conditions for comfort and safety</li> </ol>		<p><b>User Outcomes &amp; Benefits (JTBD)</b></p> <ol style="list-style-type: none"> <li>1. Easily plan outdoor routes with the most suitable environmental conditions to ensure safety and comfort.</li> <li>2. Learn about local plant and animal species seamlessly during their activities, without switching between multiple apps.</li> <li>3. Gain a deeper emotional connection with the natural environment while actively engaging with it.</li> <li>4. Expand personal knowledge of local ecosystems and biodiversity, turning outdoor activities into educational opportunities.</li> </ol>
<p><b>Hypotheses</b></p>	<p><b>What's the most important thing we need to learn first?</b></p>	<p><b>What's the least amount of work we need to do to learn the next most important thing?</b></p>

Figure 4. Early Lean UX Canvas

## 2.7. Assumptions

This project is based on the assumption that outdoor activity enthusiasts — including hikers, runners, cyclists, and campers — not only seek safe and enjoyable routes but also value learning about the natural environment they encounter. It is assumed that users are willing to engage with brief, non-intrusive educational interactions if they are integrated seamlessly into route planning and in-activity navigation. Another key assumption is that access to real-time environmental data, such as air quality, UV index, soil moisture, and crowd density, can positively influence both route choice and user safety.

From a business perspective, the project assumes that the current market lacks an integrated solution combining route planning, environmental monitoring, and biodiversity education, and that this integration will create a unique value proposition compared to existing single-function apps. These assumptions will be validated through user research and testing.

### (1) Business Assumptions

Business Assumptions	
The customer needs to...	Access reliable outdoor routes with real-time environmental data and nature-related information for a safer and more enriching experience.
The customer needs will be solved by...	Combining route planning, environmental monitoring, and in-route biodiversity education into a single mobile app.
The customers are (or will be)...	Outdoor enthusiasts aged 18–40, including hikers, runners, cyclists, and casual explorers, who are comfortable with mobile and GPS-based tools.
The customer wants... from our service	Safe, well-informed, and enjoyable outdoor activities with added learning opportunities about nature.
The customer can also get ... from our service	Environmental tips, flora and fauna identification, and seasonal nature highlights.
I will get my customer base by...	<ul style="list-style-type: none"> <li>- Friends' recommendations;</li> <li>- Collaborations with outdoor communities, sports brands, and eco-tourism organizations;</li> <li>- Social media and app store promotion.</li> </ul>
I will make money by...	Subscription & ads
My primary competition is...	Outdoor route planning apps and nature learning apps
We will beat the competition by...	Offering an integrated solution that combines navigation, environmental safety data, and nature education in one seamless experience.
My biggest risk is...	Users may see the educational component as unnecessary or too time-consuming during activities.
We will solve the risk by...	Making educational content optional, quick, and interactive
What are the assumptions we have that if proven false will make the project fail?	<ul style="list-style-type: none"> <li>- Outdoor enthusiasts value environmental safety and biodiversity knowledge alongside route planning.</li> <li>- Users are willing to engage with brief nature learning moments during or after activities.</li> </ul>

**Table 2.** Business Assumptions Table

## (2) User Assumptions

User Assumptions	
Who is the user?	People aged 18 – 40 who actively participate in outdoor activities (hiking, running, cycling, camping) and are curious about the natural environment.
Where will our product fit in the user's life?	<ul style="list-style-type: none"> <li>- Trip preparation and route selection before outdoor activities.</li> <li>- During activities for real-time safety and environmental updates.</li> </ul>
What problems does the product solve for the user?	<ul style="list-style-type: none"> <li>- Helps find safe and suitable routes based on current environmental conditions.</li> <li>- Provides quick biodiversity insights to enhance exploration.</li> </ul>
In what context does the user use the product?	Pre-trip planning, on-route navigation, and post-trip reflection/learning.
What features are essential for the user? And why?	<ul style="list-style-type: none"> <li>- Real-time environmental monitoring (air quality, UV index, soil moisture, crowd density) for safety and comfort.</li> <li>- Biodiversity identification and location-based nature facts for learning.</li> </ul>
How should the product look and behave?	<ul style="list-style-type: none"> <li>- Clear, map-based UI with layered environmental and educational data.</li> <li>- Optional, non-intrusive educational prompts during activities.</li> </ul>

**Table 3.** User Assumptions Table

## (3) Summary of Assumptions

The assumptions outlined in this section establish the foundational thinking that shaped the project's direction. From both user and business perspectives, the project assumes a demand for integrated outdoor solutions that combine route planning, environmental data, and nature education. It is expected that users are open to light educational engagement during or after outdoor activities, especially when such interactions are optional and contextually relevant. These assumptions not only inform the initial design decisions but also serve as hypotheses to be tested and refined through user research and iterative development.

## 2.8. Ideation

In this project, four ideation methods were employed to facilitate the transition from research insights to design solutions.. This process combined four complementary methods: How Might We (HMW), Crazy 8s, MoSCoW prioritisation and Bull's Eye mapping. Each method served a specific purpose and built on the outcomes of the previous one, forming a logical progression through the design thinking journey.

The ideation began with the formulation of HMW questions, which helped translate user research into clear opportunity areas. These open-ended prompts encouraged creative thinking and established the foundation for idea generation. Based on these questions, the Crazy 8s sketching technique was used to quickly visualise diverse interface concepts, focusing on key features that addressed user needs. After generating these ideas, the MoSCoW method was applied to evaluate and prioritise them according to user value, feasibility and development constraints. Finally, the Bull's Eye framework helped organise the selected features into development stages.

Together, these four methods provided a coherent and iterative structure for moving from abstract insights to concrete, user-focused design directions.

### (1) How Might We

To support the transition from research insights to actionable design directions, this project employed the How Might We (HMW) framework as a structured method for framing key user needs uncovered during the discovery phase. The decision to use HMW stemmed from the need to bridge qualitative insights from interviews and competitor analysis with concrete design opportunities that align with the dual goals of outdoor navigation and informal nature education.

The framework was used to rephrase complex user challenges into open-ended, opportunity-focused questions, ensuring that ideation remained grounded in real user contexts. For instance, HMW questions were crafted to address challenges such as integrating nature learning into outdoor activities without interrupting flow, helping users collect and learn about species in an engaging way, and translating environmental data into meaningful route recommendations. These questions served not only to inspire creative thinking during ideation, but also to maintain coherence between user needs and feature development throughout the design process.

A high-resolution version is available at the following link:

[https://kingstonuniversity-my.sharepoint.com/:i/g/personal/k2438742\\_kingston\\_ac\\_uk/EbZ9rxMse4JEjiYs2Z5p\\_UwBT\\_PsZinxjTLqZkFnY4JcEJA?e=BzLkDU](https://kingstonuniversity-my.sharepoint.com/:i/g/personal/k2438742_kingston_ac_uk/EbZ9rxMse4JEjiYs2Z5p_UwBT_PsZinxjTLqZkFnY4JcEJA?e=BzLkDU)



Figure 5. HMW

## (2) Crazy 8's

To rapidly explore solutions aligned with the previously defined HMW questions, a Crazy 8s sketching session was conducted. This technique was chosen for its ability to support divergent thinking under time constraints, which matched the project's need to quickly explore interface solutions in a fast-paced, iterative environment. By encouraging rapid visualisation of ideas, the method enabled the team to experiment with various approaches to core features, such as gamified species collection, personalised trail planning based on target species, and real-time feedback during outdoor activities. These sketches played a crucial role in translating abstract user needs into concrete visual concepts, serving as the foundation for further design.

A high-resolution version is available at the following link:

[https://kingstonuniversity-my.sharepoint.com/:i/g/personal/k2438742\\_kingston\\_ac\\_uk/EdHcKRObRBxOhk-Btb7kAUBaGmgC1MMiqG4fMRuCKNb6A?e=qNQjY4](https://kingstonuniversity-my.sharepoint.com/:i/g/personal/k2438742_kingston_ac_uk/EdHcKRObRBxOhk-Btb7kAUBaGmgC1MMiqG4fMRuCKNb6A?e=qNQjY4)



Figure 6. Crazy 8's

### (3) MoSCoW

The MoSCoW method was applied to prioritise features based on user research, technical feasibility, and the project's core goal of enhancing nature connectedness during outdoor activity. This method was particularly relevant given the project's resource and time constraints, allowing the team to focus on delivering essential functionality such as interactive ecological maps and species recognition in the initial prototype. The prioritisation was informed by interview insights, including users' desire for customisable routes and lightweight learning content. Features like social sharing and group challenges were classified as lower priority for future development. This structured decision-making process supported a clear product vision and allowed for ongoing refinement as user feedback becomes available.

A high-resolution version is available at the following link:

[https://kingstonuniversity-my.sharepoint.com/:i:/g/personal/k2438742\\_kingston\\_ac\\_uk/Eb-fVz-j7n5Dq2hLu3pwpDQBsYmGcZCHOA2sJ7KWWBPtjg?e=geBbTw](https://kingstonuniversity-my.sharepoint.com/:i:/g/personal/k2438742_kingston_ac_uk/Eb-fVz-j7n5Dq2hLu3pwpDQBsYmGcZCHOA2sJ7KWWBPtjg?e=geBbTw)

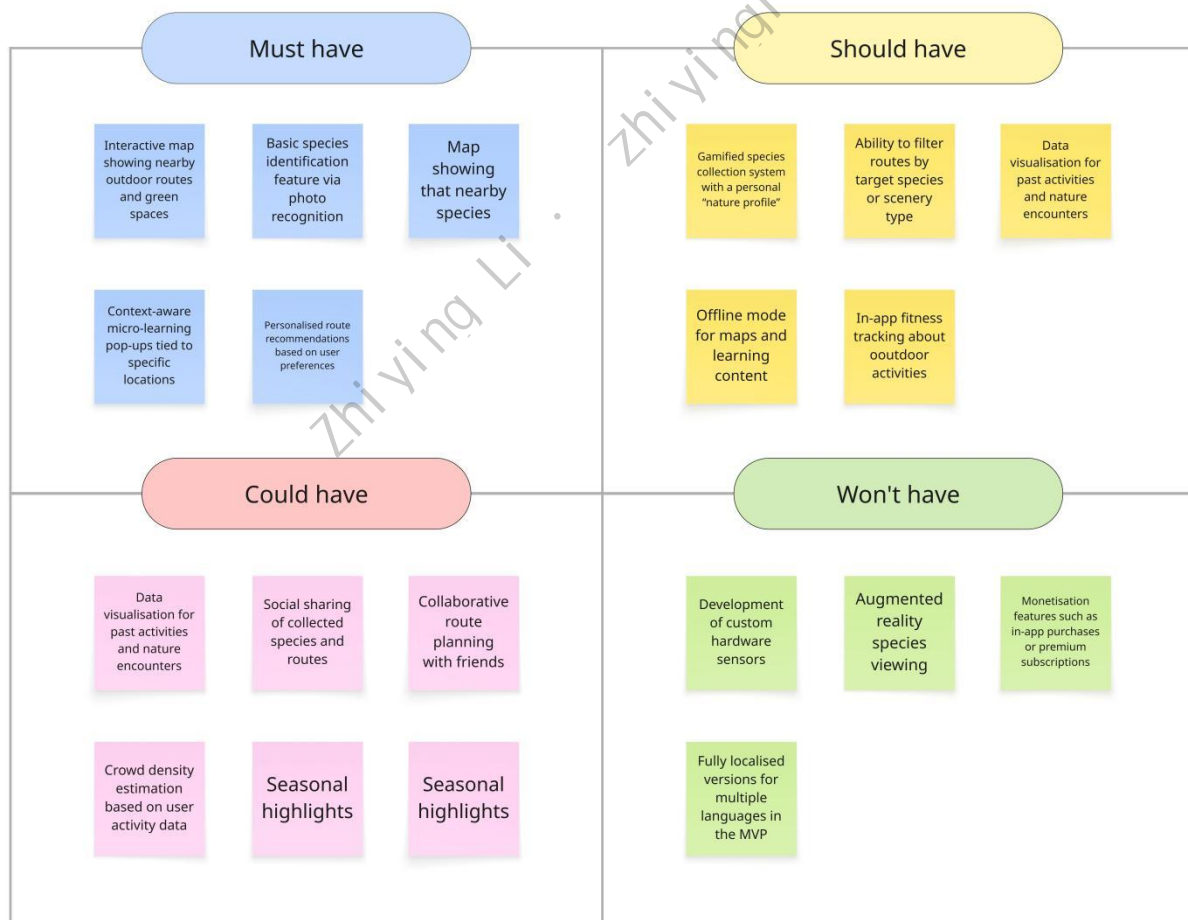


Figure 7. MoSCoW

#### (4) Bull's Eye

The Bull's Eye diagram was used to prioritise the app's potential features into three tiers: Primary, Secondary, and Tertiary. This structure ensures that core functions such as interactive ecological maps and real-time environmental data are delivered first, while more advanced or resource-intensive features are scheduled for later iterations. Such staged prioritisation aligns with agile development practices, where clear ranking helps teams maximise user value early and manage scope effectively (Rashmi Dhakad, 2020).

A high-resolution version is available at the following link:

[https://kingstonuniversity-my.sharepoint.com/:i:/g/personal/k2438742\\_kingston\\_ac\\_uk/EYTmsF7t4tdOmSlphwURiksBRWy0uWUtHYUQO\\_H11-Yu0Q?e=gixEnZ](https://kingstonuniversity-my.sharepoint.com/:i:/g/personal/k2438742_kingston_ac_uk/EYTmsF7t4tdOmSlphwURiksBRWy0uWUtHYUQO_H11-Yu0Q?e=gixEnZ)

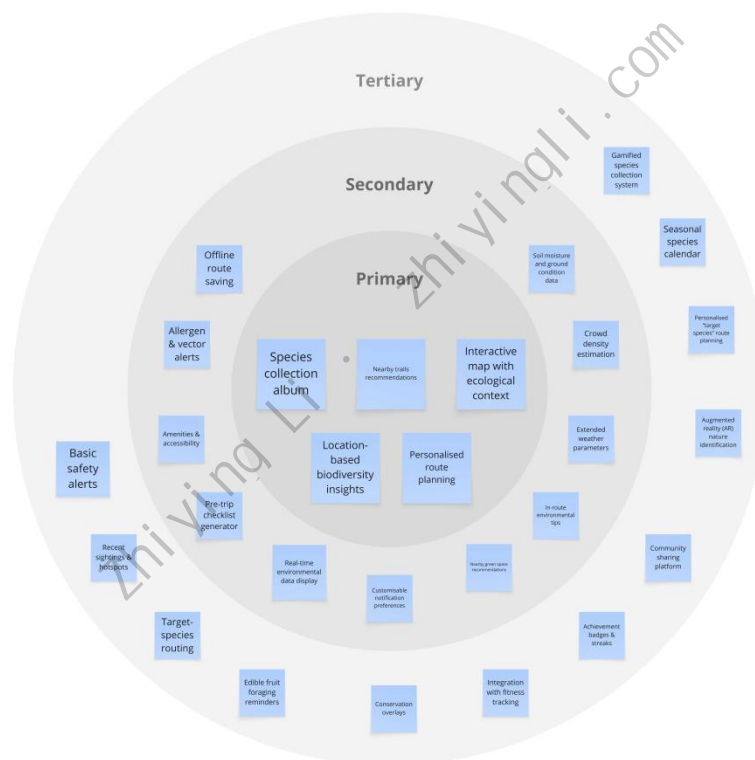


Figure 8. Bull's Eye

These five features were prioritised because they directly support the app's two main goals: enhancing outdoor activity and promoting nature engagement. Interactive ecological maps, personalised route planning, and nearby trail recommendations offer practical value for navigation and outdoor exploration. Meanwhile, the species collection album and location-based biodiversity insights serve to foster curiosity, learning, and emotional connection with nature. Together, these functions provide an integrated experience that balances usability with educational depth, making them essential to the app's core purpose.

## 2.9. Assumption Prioritizations

Following the initial formulation of assumptions, I entered the ideation phase to explore how these beliefs could shape core features and user value. The visual prioritization map categorises assumptions based on their projected impact and the effort required to validate them. This approach supports evidence-driven decision-making and helps the design team focus on assumptions that are both highly influential and feasible to explore early.

A high-resolution version is available at the following link:

[https://kingstonuniversity-my.sharepoint.com/:i:/g/personal/k2438742\\_kingston\\_ac\\_uk/EW04JOZ7e1IGusnMIMJw2RUBln8dRaDPoqhvBb2\\_vZMvSQ?e=YqkZPj](https://kingstonuniversity-my.sharepoint.com/:i:/g/personal/k2438742_kingston_ac_uk/EW04JOZ7e1IGusnMIMJw2RUBln8dRaDPoqhvBb2_vZMvSQ?e=YqkZPj)

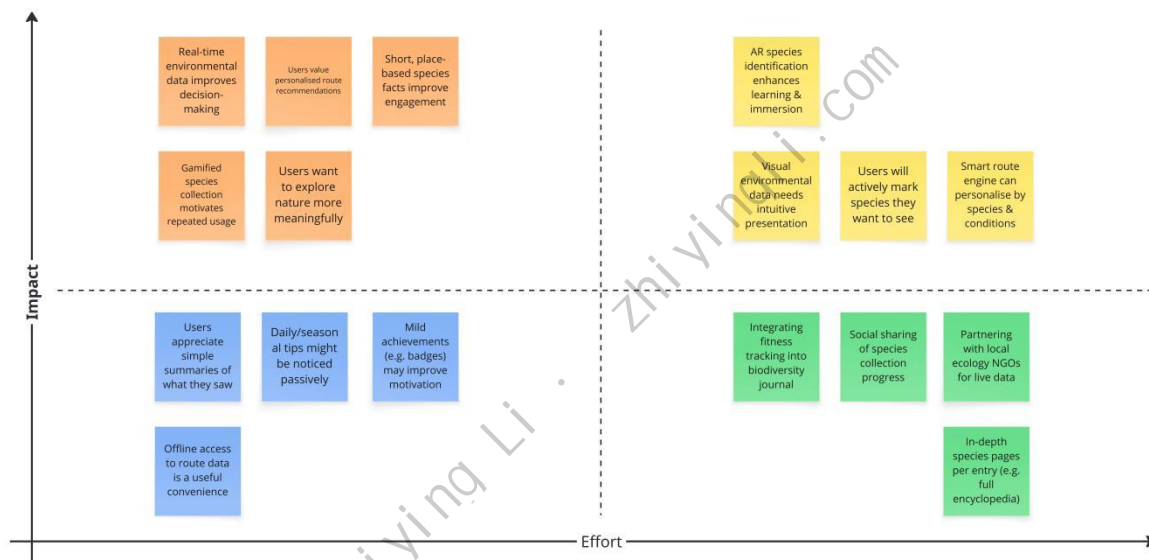


Figure 9. Assumption Prioritizations

The prioritization exercise clarified which assumptions should guide the early design and testing stages. By focusing on ideas with high impact and manageable effort, the project can reduce risk while enhancing user relevance. These prioritised assumptions form the basis for key features to prototype and validate in the next iteration.

## 2.10. Mental Models

To support the transition from user assumptions into actionable design insights, a mental model was developed to map the emotional and cognitive journey of users engaging with the proposed app. This model is informed by initial assumptions regarding users' interest in outdoor activities, their receptiveness to lightweight educational content, and their prioritisation of safety and discovery. It illustrates how users' thoughts, needs, and expectations evolve across different stages of interaction with the app.

The model highlights both the app events and the corresponding mental snippets users may experience, from the initial discovery phase to post-activity reflection. By capturing these underlying motivations and behavioural cues, the design process becomes more attuned to real user goals, ultimately informing intuitive interaction flows, timely educational content delivery, and sustained engagement strategies.

A high-resolution version is available at the following link: [https://kingstonuniversity-my.sharepoint.com/:i:/g/personal/k2438742\\_kingston\\_ac\\_uk/EfLzaEKgc7NChBJCizNQVU4BwUCd32MI7729YPj8GyEurg?e=5JF7wk](https://kingstonuniversity-my.sharepoint.com/:i:/g/personal/k2438742_kingston_ac_uk/EfLzaEKgc7NChBJCizNQVU4BwUCd32MI7729YPj8GyEurg?e=5JF7wk)

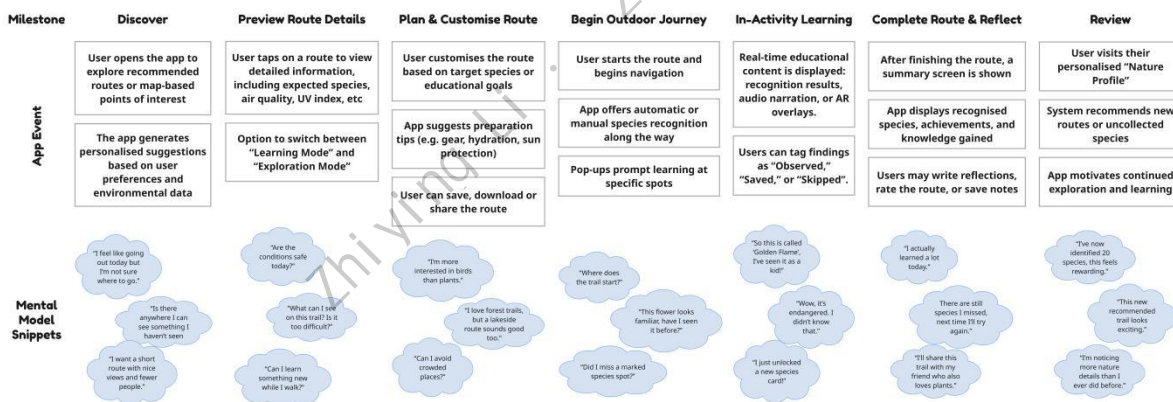


Figure 10. Mental Models

This mental model highlights a holistic user journey, from initial exploration and route discovery to post-activity reflection and motivation for future learning. It captures not only functional interactions with the app but also the underlying thoughts, needs, and emotional drivers at each stage. These insights reveal users' desire for safe, enriching, and personalised outdoor experiences, as well as their openness to real-time learning and environmental awareness. By aligning app functionalities with evolving mental states, this model provides a strong foundation for the following stages of thinking and making.

## 2.11. Persona

To design a user experience that aligns with users' expectations and behaviours, two personas were developed to reflect contrasting motivations, habits, and technological familiarity. These personas informed the construction of a mental model that outlines the users' cognitive processes throughout their interaction with the app. By mapping out key moments from discovery to reflection, the model captures users' thoughts, decisions, and emotional responses during their exploration journey. This approach ensures that the app addresses both practical needs and personal goals, supporting a more intuitive and engaging nature-based experience.

Priya represents a goal-oriented learner who actively seeks educational depth in her outdoor experiences. As an international undergraduate student in Environmental Science, she regularly engages in structured outdoor activities to explore ecological systems. Her moderate tech usage is driven by the need to track, document, and reflect on nature-based observations. She values customisable planning tools, accurate recognition features, and the ability to collect and organise findings. Her exploration is purposeful and often connected to academic goals, with a strong motivation to gain knowledge and share insights with peers.

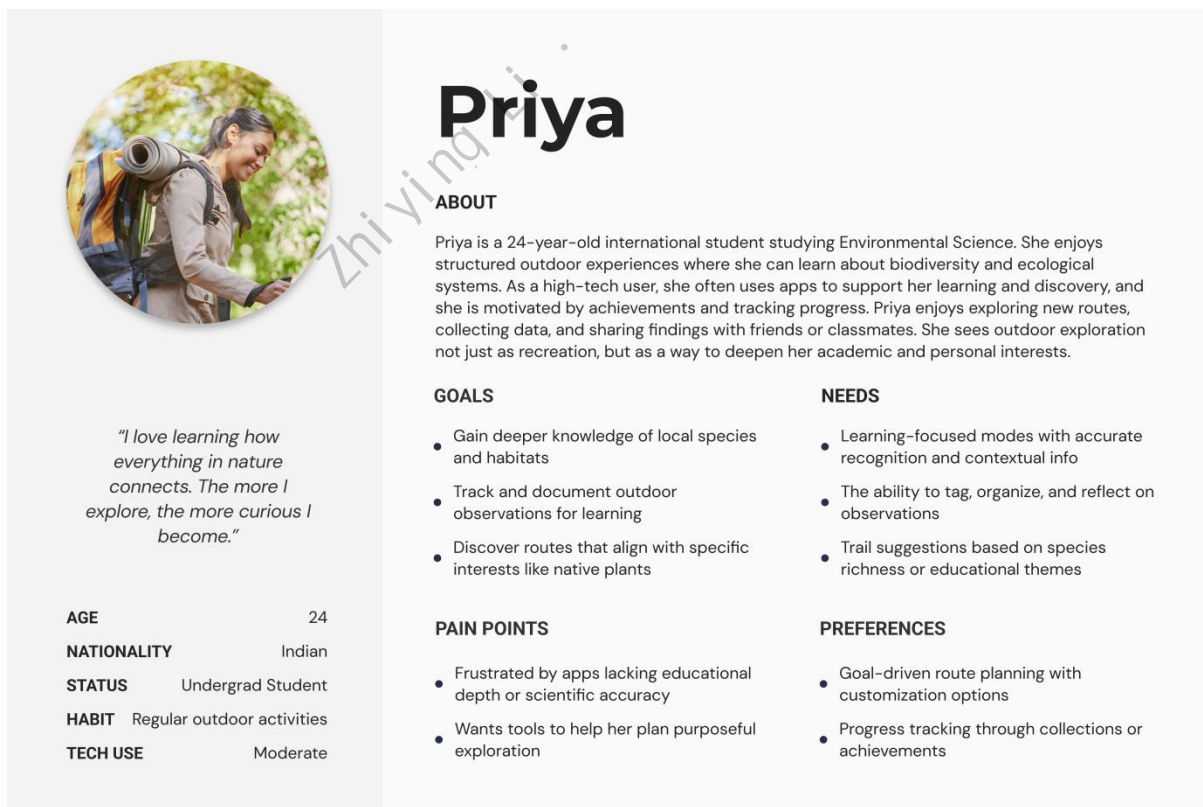


Figure 11. Persona 1

Alex represents a spontaneous explorer who values simplicity and visual experiences. As a photographer, he is inspired by nature but prefers intuitive tools that support his spontaneous habits and creative flow. His exploration is driven by curiosity and relaxation rather than structured learning. He prefers minimal UI, gentle prompts, and functionality that enhances his outdoor experience without disrupting it.

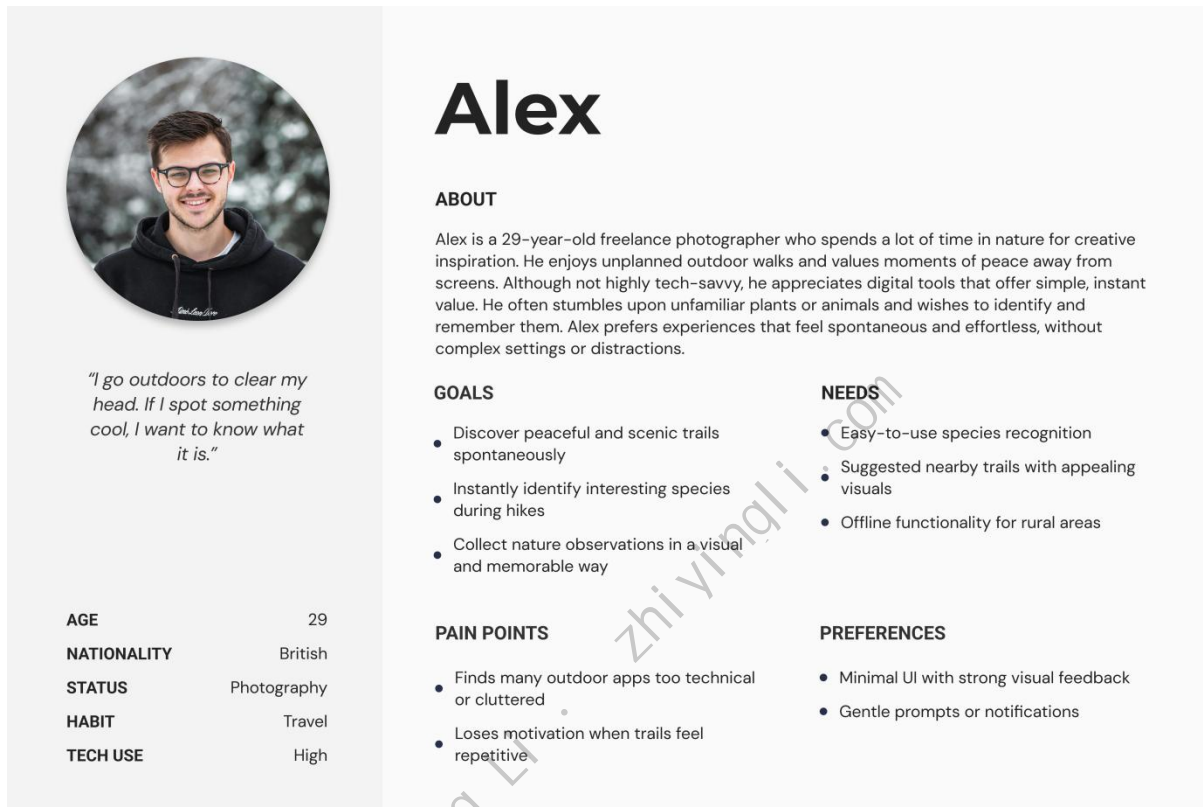


Figure 12. Persona 2

A high-resolution version is available at the following link:

[https://kingstonuniversity-my.sharepoint.com/:i:/g/personal/k2438742\\_kingston\\_ac\\_uk/EaKgDqTvNqBFhgQu8kRkNjMB7Lf1AAyj9poQ\\_NqjGI2EKA?e=FGzAun](https://kingstonuniversity-my.sharepoint.com/:i:/g/personal/k2438742_kingston_ac_uk/EaKgDqTvNqBFhgQu8kRkNjMB7Lf1AAyj9poQ_NqjGI2EKA?e=FGzAun)

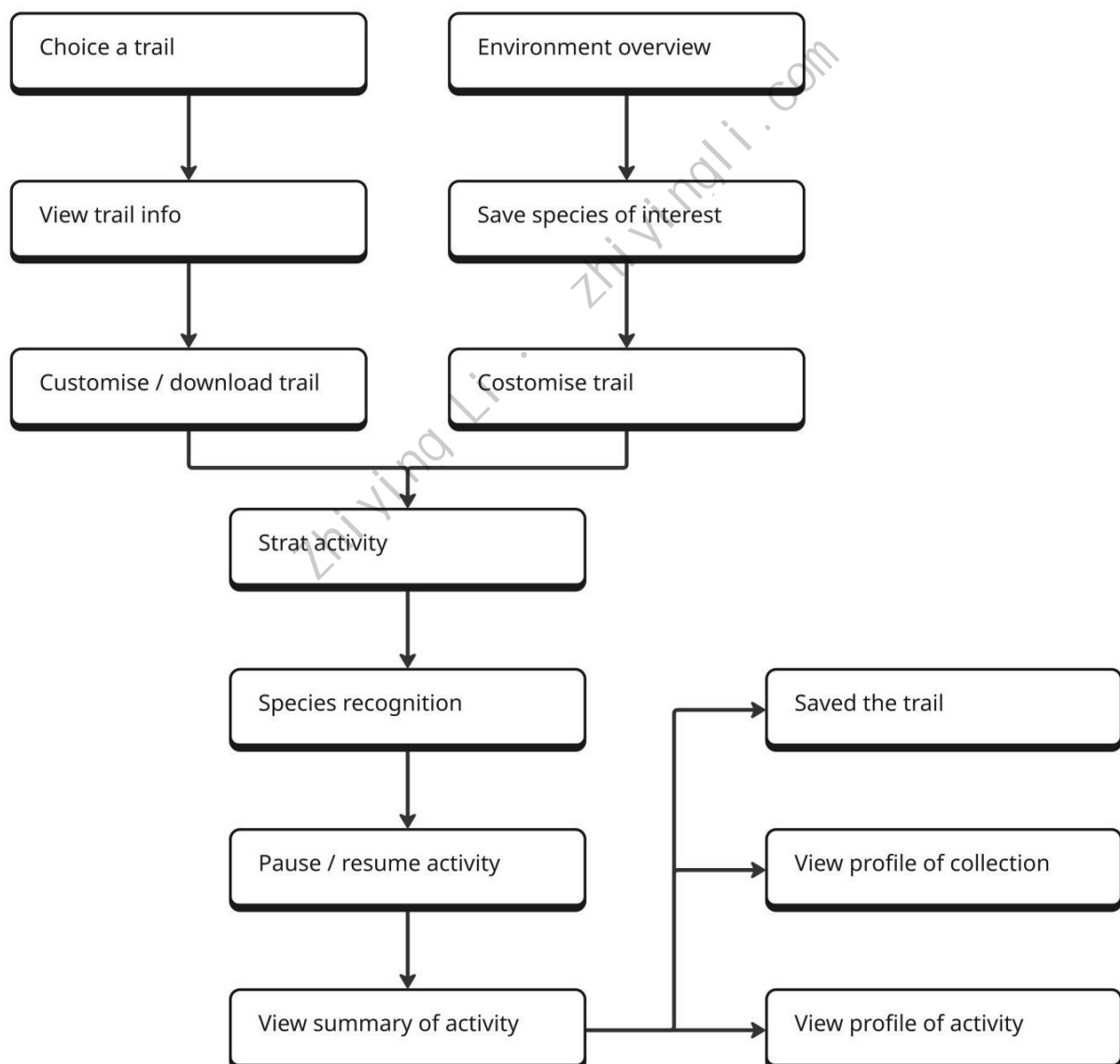
These two personas highlight different motivations and behaviours in outdoor exploration. While Priya values structured learning and scientific discovery, Alex seeks spontaneous, visually engaging experiences with minimal cognitive load. Despite their differences, both users benefit from features that support species recognition, personalised route suggestions, and reflection tools. Designing for both types of users ensures the app offers a flexible and inclusive experience that accommodates a range of goals, from educational engagement to creative inspiration.

## 2.12. Initial User Flow

This user flow is designed based on the goals and behaviours of the two key personas. It shows how users can start by selecting a trail or browsing environmental data, then customise their route based on interests. During the activity, species recognition supports exploration, with options to pause or resume. After the journey, users can review summaries, collections, and saved trails. The flow balances structured learning with flexible discovery.

A high-resolution version is available at the following link:

[https://kingstonuniversity-my.sharepoint.com/:i:/g/personal/k2438742\\_kingston\\_ac\\_uk/EVYzAchy7ORDlwCxRB3sXFWBtPENoDvkc09IUstDEIHhs9w?e=PgM4RR](https://kingstonuniversity-my.sharepoint.com/:i:/g/personal/k2438742_kingston_ac_uk/EVYzAchy7ORDlwCxRB3sXFWBtPENoDvkc09IUstDEIHhs9w?e=PgM4RR)



**Figure 13.** Initial User Flow

## 2.13. Customer Journey Map

This customer journey map builds on the previous user flow and visualises how different user types experience the system across six key stages. It highlights needs, thoughts, and opportunities for improvement.

A high-resolution version is available at the following link:

[https://kingstonuniversity-my.sharepoint.com/:i/g/personal/k2438742\\_kingston\\_ac\\_uk/ERc9jRRgoa1CneEkWa6itg4B NNEEmqKWkbtbk8klThs94w?e=lcQKqa](https://kingstonuniversity-my.sharepoint.com/:i/g/personal/k2438742_kingston_ac_uk/ERc9jRRgoa1CneEkWa6itg4B NNEEmqKWkbtbk8klThs94w?e=lcQKqa)

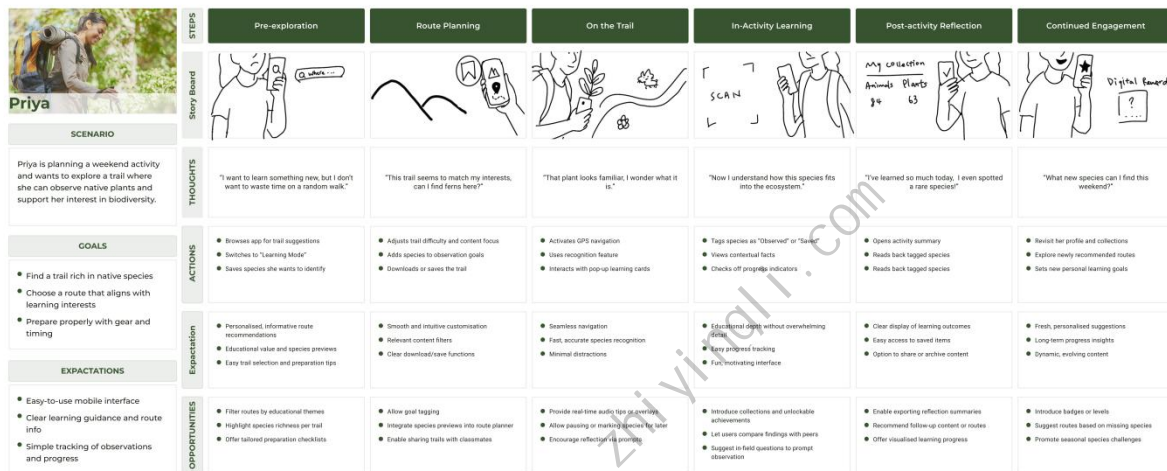


Figure 14. Customer Journey Map - 1

A high-resolution version is available at the following link:

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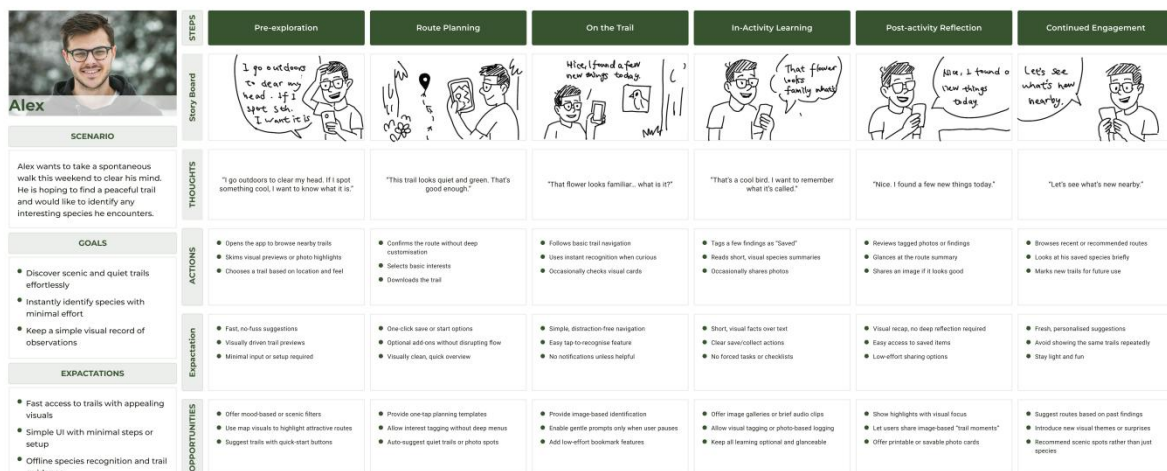


Figure 15. Customer Journey Map - 2

The two customer journey maps illustrate how different user types interact with the outdoor exploration app. Each map focuses on a unique user profile with distinct motivations, behaviours, and expectations.

The first map represents Priya, a goal-driven user with a strong interest in biodiversity and learning. Her journey begins with intentional planning. She actively explores educational routes, selects species she wishes to study, and customises trails according to her academic interests. Her actions are focused and informed by her desire for structured knowledge and progress tracking. Her experience highlights the need for detailed species previews, learning prompts, and personalised trail planning features that support long-term engagement and educational value.

The second map reflects Alex, a spontaneous user who prefers minimal effort and intuitive interaction. He seeks a peaceful walk and uses the app mainly for casual species identification. His journey is faster and less structured. He relies on visual cues and simple interfaces to choose a trail and identify interesting findings along the way. His behaviour suggests a need for quick-start features, offline recognition tools, and minimal cognitive load throughout the experience.

In summary, the two journey maps reveal the importance of designing for both structured learners and casual explorers. While Priya values educational depth and goal-oriented tracking, Alex prioritises ease of use and immediate feedback. These maps help identify opportunities to support different user needs while maintaining a cohesive experience.

## 3. Make

### 3.1. Hypothesis

#### (1) Hypothesis Statement

Following the customer journey analysis, several design hypotheses were developed to address the key needs, behaviours, and motivations identified across different user types. These hypotheses are grounded in the opportunities observed within the journey maps and aim to inform the next stage of design decisions. Each hypothesis proposes a way to enhance user engagement, improve outdoor planning, and deepen users' connection to nature through contextual and personalised features.

The following are the hypotheses developed based on these insights:

**I believe that we will** help users feel more connected to nature  
**if** they are exposed to local biodiversity in context  
**with** short, place-based species insights during their outdoor activity.

**I believe that we will** improve outdoor decision-making  
**if** users can mark the species they are interested in seeing  
**with** personalised route recommendations based on their preferences.

**I believe that we will** encourage more mindful and safe outdoor practices  
**if** users can plan routes based on live environmental and biodiversity data  
**with** smart, personalised route recommendations.

**I believe that we will** increase users' curiosity and knowledge about nature  
**if** we integrate lightweight educational content into their routines  
**with** visual markers and short pop-ups along their hiking routes.

**I believe that we will** encourage return usage of the app  
**if** users feel a sense of achievement and discovery  
**with** a profile that tracks and displays their encountered species like a collection.

## (2) Hypothesis Table

The hypothesis table connects business goals with specific user outcomes and design features. Each row demonstrates how the proposed features can support a particular user persona and deliver measurable benefits. This table also helps ensure that design decisions are grounded in real user needs while aligning with strategic product objectives.

We will achieve... (Business Outcomes)	If this user... (Persona)	Can achieve... (User Outcomes)	With this feature. (Features)
Increase emotional connection with nature	Alex – a weekend hiker who enjoys observing wildlife	Feels more emotionally connected to natural surroundings	Place-based species insights during the hike
Improve outdoor decision-making	Priya – a nature-lover who wants to see specific animals during her trips	Plans more informed routes based on species preferences	Personalised route suggestions based on marked interests
Encourage safer and more mindful outdoor activities	Leo – a runner who checks weather and trail conditions before heading out	Avoids risky areas and adjusts plans accordingly	Real-time environmental data + dynamic route recommendations
Increase curiosity and ecological awareness	Mia – a student who wants to learn about plants during outdoor walks	Learns interesting facts about nearby species in real time	Pop-up facts and map markers linked to species info
Encourage repeat engagement with the app	Ben – a camper who likes tracking his nature discoveries	Returns to the app to grow and view his species collection	Profile with species logbook and collection system

**Table 4.** Hypothesis Table

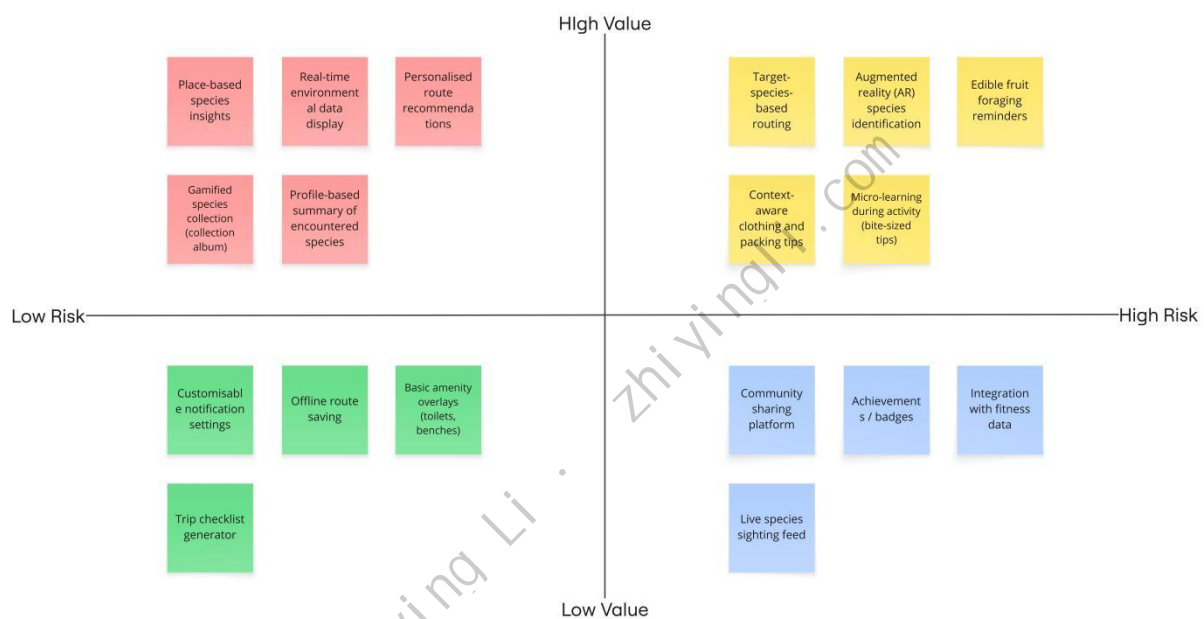
The hypothesis table outlines a clear connection between business outcomes, user personas, and targeted feature designs. By aligning specific features with different users' needs and contexts, the table demonstrates how the product can deliver value across multiple dimensions. This structured approach ensures that each design decision contributes to both user satisfaction and strategic goals.

### (3) Hypothesis Prioritization

To guide design focus, hypotheses were mapped on a value–risk matrix based on their potential impact and implementation feasibility. Ideas in the high-value, low-risk quadrant are considered priority candidates for development. This method supports informed decision-making by balancing innovation potential with realistic constraints.

A high-resolution version is available at the following link:

[https://kingstonuniversity-my.sharepoint.com/:i/g/personal/k2438742\\_kingston\\_ac\\_uk/EYTmwMjD5pplvrYoHGqYqcBWGNxadD3UfMbofuL-b3c9w?e=Pgr56Z](https://kingstonuniversity-my.sharepoint.com/:i/g/personal/k2438742_kingston_ac_uk/EYTmwMjD5pplvrYoHGqYqcBWGNxadD3UfMbofuL-b3c9w?e=Pgr56Z)



**Figure 16.** Hypothesis Prioritization

The hypothesis prioritization chart evaluates proposed features based on their potential value and implementation risk. Key high-value, low-risk features such as place-based species insights and personalised route recommendations are positioned as immediate priorities. High-value but high-risk ideas, like AR species identification and target-species routing, offer future innovation opportunities. Meanwhile, features with lower value or higher complexity, such as community sharing or fitness integration, are deprioritized. This framework supports strategic, user-focused feature development while balancing feasibility.

### 3.2. Initial Information Architecture

This initial information architecture outlines the main content structure of the app, organised into four key areas: Explore, Navigate, Saved, and Profile. It reflects user needs identified in the hypotheses and supports intuitive access to trails, species info, and personal collections.

A high-resolution version is available at the following link:

[https://kingstonuniversity-my.sharepoint.com/:i:/g/person/k2438742\\_kingston\\_ac\\_uk/Ecjg88kwPG9KkxU3teJUTYQBIDwTNaPG9uLTuZZBsAJAnw?e=KgvFfj](https://kingstonuniversity-my.sharepoint.com/:i:/g/person/k2438742_kingston_ac_uk/Ecjg88kwPG9KkxU3teJUTYQBIDwTNaPG9uLTuZZBsAJAnw?e=KgvFfj)

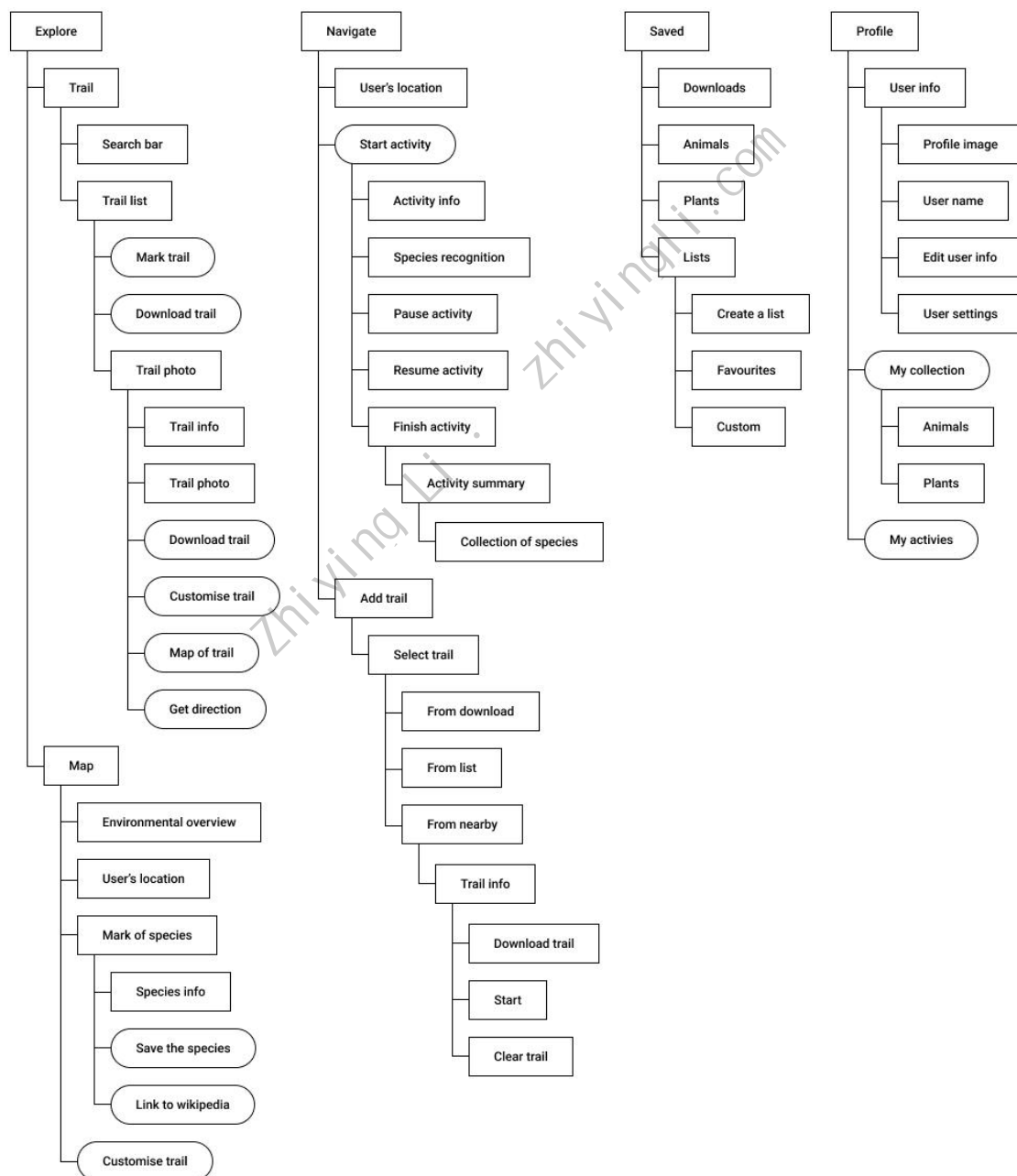


Figure 17. Initial Information Architecture

### 3.3. Lo-fi Prototype

Following the initial information architecture, I developed a low-fidelity prototype that closely aligns with its core structure. The interface is organised into four main sections including Home, Navigate, Saved, and Profile. This ensures consistency between the structural framework and the visual design.

A high-resolution version is available at the following link:

[https://kingstonuniversity-my.sharepoint.com/:i/g/personal/k2438742\\_kingston\\_ac\\_uk/ESzP8qCwvBpJiZhd11Xu8FQBazc52sMA2S6fW98XtbH0wg?e=ub0aSh](https://kingstonuniversity-my.sharepoint.com/:i/g/personal/k2438742_kingston_ac_uk/ESzP8qCwvBpJiZhd11Xu8FQBazc52sMA2S6fW98XtbH0wg?e=ub0aSh)

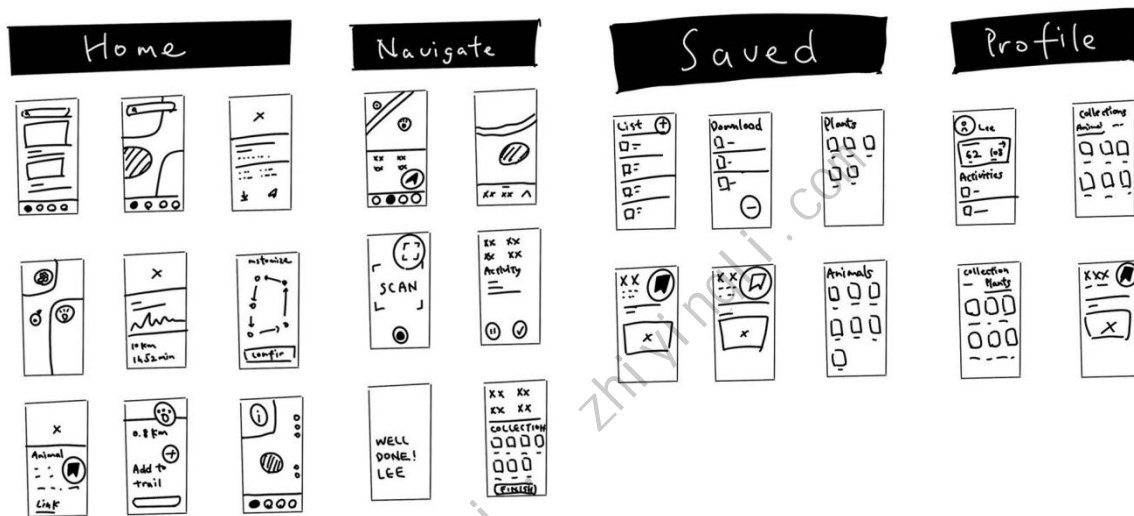


Figure 18. Lo-fi Prototype

The low-fidelity prototype presents the primary screens and key interaction flows of the application. Based on the information architecture, I designed functions such as bookmarking animals and plants, viewing their locations, and planning routes according to specific species of interest. These features are intended to support both casual exploration and intentional outdoor learning.

### 3.4. Midi-fi Wireframe

Building upon the low-fidelity prototype, I developed a mid-fidelity version to refine the structure and visual clarity. This version maintains the original navigation logic while enhancing the layout and interface consistency.

A high-resolution version is available at the following link:

[https://kingstonuniversity-my.sharepoint.com/:i/g/personal/k2438742\\_kingston\\_ac\\_uk/EU88m\\_rdrbhDnaBHbiu9vmUBXZ9UAclVRmWdyjkiDctybQ?e=OmrVe7](https://kingstonuniversity-my.sharepoint.com/:i/g/personal/k2438742_kingston_ac_uk/EU88m_rdrbhDnaBHbiu9vmUBXZ9UAclVRmWdyjkiDctybQ?e=OmrVe7)

A clickable Figma prototype is available at the following link:

<https://www.figma.com/proto/3X1Ua56hAgW1OuYFzr1y7P/Final?node-id=5-2&p=f&t=pKw3y6Pd6GCDYrVK-0&scaling=scale-down&content-scaling=fixed&starting-point-node-id=275%3A1203&show-proto-sidebar=1>



Figure 19. Mid-fi Prototype

The mid-fidelity prototype further explores user interactions and interface behaviour in greater detail. It incorporates key features such as trail selection, live navigation, species recognition, and collection tracking. The design focuses on usability, aiming to deliver a clean and efficient experience for users engaging with nature-based activities.

### 3.5. Lean UX Canvas

After designing the mid-fidelity prototype, I revisited and refined the strategic foundation of the project. To better align the design decisions with real user and business needs, I developed a Lean Strategy Canvas and an updated Lean UX Canvas.

The Lean Strategy Canvas outlines the core goal, obstacle, and strategic direction for the product. It highlights a gap in the market for a tool that integrates route planning, real-time environmental data, and biodiversity education. The canvas defines a focused objective and clarifies the intended strategy for winning user trust and delivering value.

A high-resolution version is available at the following link:

[https://kingstonuniversity-my.sharepoint.com/:i:/g/personal/k2438742\\_kingston\\_ac\\_uk/EeCJubmziydIlcWcJMqPrA0B0HUC-mVEj3JMgbWj0D6gpg?e=ZqDbsK](https://kingstonuniversity-my.sharepoint.com/:i:/g/personal/k2438742_kingston_ac_uk/EeCJubmziydIlcWcJMqPrA0B0HUC-mVEj3JMgbWj0D6gpg?e=ZqDbsK)

Lean Strategy Canvas		
<p><b>Goal</b></p> <p>Urban and suburban outdoor enthusiasts lack an integrated tool that combines route planning, real-time environmental data, and in-route biodiversity education. Existing products offer these features separately, resulting in missed opportunities for richer, safer, and more meaningful nature experiences.</p>	<p><b>Strategy</b></p> <p><small>An opinionated and coherent approach to addressing an important challenge. (Hint: Strategy isn't a plan. It's also not a list of features or services. Instead, it expresses the way you intend to overcome your challenge. It is probably a mix of policy ("premium pricing") and planned actions ("create a focused product line.")</small></p> <p><b>Where will you play?</b></p> <p>Urban and suburban outdoor enthusiasts lack an integrated tool that combines route planning, real-time environmental data, and in-route biodiversity education. Existing products offer these features separately, resulting in missed opportunities for richer, safer, and more meaningful nature experiences.</p>	<p><b>Objectives and Key Results</b></p> <p><small>This is your high-level goal for measuring progress towards achieving your strategy. Your strategic statement can serve as the basis for your objective statement. (Hint: OKRs often function as leading indicators to the overall corporate goal.)</small></p> <p><b>Objective:</b></p> <p>Urban and suburban outdoor enthusiasts lack an integrated tool that combines route planning, real-time environmental data, and in-route biodiversity education. Existing products offer these features separately, resulting in missed opportunities for richer, safer, and more meaningful nature experiences.</p>
<p><b>Obstacle</b></p> <p>Urban and suburban outdoor enthusiasts lack an integrated tool that combines route planning, real-time environmental data, and in-route biodiversity education. Existing products offer these features separately, resulting in missed opportunities for richer, safer, and more meaningful nature experiences.</p>	<p><b>How will you win?</b></p> <p>Urban and suburban outdoor enthusiasts lack an integrated tool that combines route planning, real-time environmental data, and in-route biodiversity education. Existing products offer these features separately, resulting in missed opportunities for richer, safer, and more meaningful nature experiences.</p>	<p><b>Key Results:</b></p> <p>Urban and suburban outdoor enthusiasts lack an integrated tool that combines route planning, real-time environmental data, and in-route biodiversity education. Existing products offer these features separately, resulting in missed opportunities for richer, safer, and more meaningful nature experiences.</p>

Figure 20. Lean Strategy Canvas

The updated Lean UX Canvas builds on earlier hypotheses and user insights. It details the target users, proposed solutions, expected outcomes, and learning priorities. This canvas helps ensure that the product remains user-centered and hypothesis-driven, while also addressing broader ecological learning goals.

A high-resolution version is available at the following link:

[https://kingstonuniversity-my.sharepoint.com/:i:/g/personal/k2438742\\_kingston\\_ac\\_uk/EeenZYAErNIEvFrDcJfY\\_8ABCr3EnDb5fKlJu27Z7GNnaA?e=fYWMrc](https://kingstonuniversity-my.sharepoint.com/:i:/g/personal/k2438742_kingston_ac_uk/EeenZYAErNIEvFrDcJfY_8ABCr3EnDb5fKlJu27Z7GNnaA?e=fYWMrc)

Lean UX Canvas - Updated		
<p><b>Business Problem</b></p> <p>Urban and suburban outdoor enthusiasts lack an integrated tool that combines route planning, real-time environmental data, and in-route biodiversity education. Existing products offer these features separately, resulting in missed opportunities for richer, safer, and more meaningful nature experiences.</p>	<p><b>Solutions</b></p> <ol style="list-style-type: none"> <li>1. Easily plan outdoor routes with the most suitable environmental conditions to ensure safety and comfort.</li> <li>2. Receive smart recommendations for the best route and appropriate clothing based on current weather and environmental data.</li> <li>3. Learn about local plant and animal species seamlessly during their activities, without switching between multiple apps.</li> <li>4. Gain a deeper emotional connection with the natural environment while actively engaging with it.</li> <li>5. Expand personal knowledge of local ecosystems and biodiversity, turning outdoor activities into educational opportunities.</li> </ol>	<p><b>Business Outcomes</b></p> <ol style="list-style-type: none"> <li>1. Validate whether design improves user engagement and satisfaction in outdoor activities</li> <li>2. Identify how real-time environmental data influences outdoor decision-making and perceived safety</li> <li>3. Evaluate if the app increases users' awareness and curiosity about local biodiversity</li> <li>4. Gather qualitative insights into how combining exploration and education changes emotional connection with nature</li> <li>5. Produce usability test results to inform future design iterations and academic discussion</li> </ol>
<p><b>Users</b></p> <ol style="list-style-type: none"> <li>1. Nature-loving hikers, runners, and cyclists</li> <li>2. Casual weekend explorers who want to learn about local flora and fauna</li> <li>3. Campers who value environmental conditions for comfort and safety</li> </ol>		<p><b>User Outcomes &amp; Benefits (JTBD)</b></p> <ol style="list-style-type: none"> <li>1. Easily plan outdoor routes with the most suitable environmental conditions to ensure safety and comfort.</li> <li>2. Learn about local plant and animal species seamlessly during their activities, without switching between multiple apps.</li> <li>3. Gain a deeper emotional connection with the natural environment while actively engaging with it.</li> <li>4. Expand personal knowledge of local ecosystems and biodiversity, turning outdoor activities into educational opportunities.</li> </ol>
<p><b>Hypotheses</b></p> <p>I believe that we will help users feel more connected to nature if they are exposed to local biodiversity in context with short, place-based species insights during their outdoor activity.</p> <p>I believe that we will improve outdoor decision-making if users can mark the species they are interested in, seeing with personalised route recommendations based on their preferences.</p> <p>I believe that we will encourage more mindful and safe outdoor practices if users can plan routes based on live environmental and biodiversity data with smart, personalised route recommendations.</p> <p>I believe that we will increase users' curiosity and knowledge about nature if we integrate lightweight educational content into their routines with visual markers and short pop-ups along their hiking routes.</p> <p>I believe that we will encourage return usage of the app if users feel a sense of achievement and discovery with a profile that tracks and displays their encountered species like a collection.</p>	<p><b>What's the most important thing we need to learn first?</b></p> <p>We believe that integrating route planning, environmental data, and location-aware nature education into an app will:</p> <ol style="list-style-type: none"> <li>1. Help users make better route choices based on comfort and safety</li> <li>2. Increase their awareness and knowledge of local ecosystems</li> <li>3. Enhance emotional connection to nature and encourage repeat engagement</li> </ol>	<p><b>What's the least amount of work we need to do to learn the next most important</b></p> <p>We believe that integrating route planning, environmental data, and location-aware nature education into an app will:</p> <ol style="list-style-type: none"> <li>1. Help users make better route choices based on comfort and safety</li> <li>2. Increase their awareness and knowledge of local ecosystems</li> <li>3. Enhance emotional connection to nature and encourage repeat engagement</li> </ol>

Figure 21. Lean UX Canvas - Updated

## 4. Check

### 4.1. Usability Testing

In this test, the maximum allowable time was set to 90 seconds, with 0 errors and 0 assists as the performance benchmark. To calculate the final score for each hypothesis task, the average performance metrics across all five participants were first computed. Specifically, the average time spent, average number of errors, and average number of assists were derived by aggregating individual values and dividing by the number of participants. These average values were then used to calculate normalized sub-scores across the three dimensions:

- Average Time Score =  $1 - (\text{Average time taken} / \text{Maximum allowable time})$
- Average Error Score =  $1 - (\text{Average number of errors} / \text{Maximum allowed errors})$
- Average Assist Score =  $1 - (\text{Average number of assists} / \text{Maximum allowed assists})$

These sub-scores were then weighted and combined using the same formula applied at the individual level to produce an overall performance score for each task:

Final Task Score =  $(\text{Average Time Score} \times 0.5) + (\text{Average Error Score} \times 0.25) + (\text{Average Assist Score} \times 0.25)$

To derive the final score, I averaged participants' performance metrics and applied weighted values to produce a single usability score per task. This aggregated scoring method enables a consistent and interpretable evaluation of each task's usability, facilitating meaningful comparisons across hypotheses and identifying strengths and areas for improvement in the prototype.

Based on predefined hypothesis statements, this usability test aimed to validate whether core features supported users in reducing impulse spending and improving financial awareness. Five participants were recruited to complete tasks aligned with each hypothesis. Each task was mapped to a specific feature, allowing clear evaluation of function usability and user reactions. Usability testing provided practical insight into real user behavior and helped validate design directions through task success rates and qualitative feedback.

The five hypothesis-driven tasks and their corresponding feature testing goals are outlined in Table 5 below, providing a structured basis for evaluating usability across the app's core functions.

Hypothesis	Usability Test according to Hypothesis Statement
H1	Select a nearby trail on the homepage to view brief trail information and illustrations, and click on the flora and fauna icons on the map.
H2	Find and save two plants and one animal of interest from the map around your current location.
H3	Use the personalised route feature by clicking on the species you just saved, generate a custom route, and add it to your favourites.
H4	Record your activities. During the activity, use the species recognition feature once to identify a plant or animal you encounter. After completing the activity, view the summary to see which species you encountered.
H5	Go to your Profile page. Review the plant and animal species you've collected and the routes you've completed. Tap on one species card to view its detailed information.

**Table 5.** Usability Task Table

### (1) Hypothesis One

This task required participants to select a nearby trail from the homepage and view its brief information, including illustrations of flora and fauna. Participants were also expected to interact with biodiversity icons on the trail map to simulate a basic exploration experience.

Participant ID	Time	Number of Errors	Number of Assists	Result
P1	35 Sec	0	1	Pass
P2	32 Sec	0	0	Pass
P3	30 Sec	0	0	Pass
P4	60 Sec	0	1	Pass
P5	41 Sec	0	0	Pass
Average	39.6 Sec	0	0.4	
Score	0.6952	1	0.75	
Final Score	80.67%			

**Table 6.** Task Result Table 1

## (2) Hypothesis Two

Participants were instructed to navigate the map around their current location to find and save two plant species and one animal species of interest. This task tested the discoverability and functionality of the interactive map and save feature.

Participant ID	Time	Number of Errors	Number of Assists	Result
P1	20 Sec	0	1	Pass
P2	98 Sec	0	2	Pass
P3	31 Sec	0	0	Pass
P4	50 Sec	0	1	Pass
P5	13 Sec	0	0	Pass
Average	42.4 Sec	0	0.8	
Score	0.547	1	0.6	
Final Score	67.35%			

Table 7. Task Result Table 2

## (3) Hypothesis Three

This task focused on using the personalised route generation feature. Participants were asked to select species they had previously saved, use them to generate a custom trail, and add the route to their favourites. It tested cross-feature navigation and user flow clarity.

Participant ID	Time	Number of Errors	Number of Assists	Result
P1	51 Sec	0	1	Pass
P2	60 Sec	0	1	Pass
P3	107 Sec	0	1	Pass
P4	42 Sec	0	0	Pass
P5	25 Sec	0	0	Pass
Average	57 Sec	0	0.6	
Score	0.3667	1	0.7	
Final Score	60.84%			

Table 8. Task Result Table 3

#### (4) Hypothesis Four

Participants were asked to start and record an activity, use the species recognition function during the journey, and then finish the session to review the summary of encountered species. This task tested the in-activity features and end-of-activity feedback.

Participant ID	Time	Number of Errors	Number of Assists	Result
P1	57 Sec	0	0	Pass
P2	104 Sec	0	1	Pass
P3	90 Sec	0	0	Pass
P4	90 Sec	0	0	Pass
P5	50 Sec	0	0	Pass
Average	78.2 Sec	0	0.2	
Score	0.1311	1	0.9	
Final Score	54.06%			

Table 9. Task Result Table 4

#### (5) Hypothesis Five

The final task directed participants to the profile page, where they reviewed the plants and animals collected, as well as completed routes. They were expected to tap on a species card to view its detailed information, testing the content organisation.

Participant ID	Time	Number of Errors	Number of Assists	Result
P1	15 Sec	0	0	Pass
P2	54 Sec	0	0	Pass
P3	41 Sec	0	0	Pass
P4	40 Sec	0	0	Pass
P5	23 Sec	0	0	Pass
Average	34.6 Sec	0	0	
Score	0.6156	1	1	
Final Score	80.78%			

Table 10. Task Result Table 5

## (6) Conclusion

According to Nielsen and Landauer (1993), testing with five users is sufficient to uncover most usability issues, which reinforces the reliability of the observed results. All five participants successfully completed all assigned tasks, resulting in an average final usability score of 68.78%.

While the completion rate was high, the evaluation scores revealed variation in performance across different task flows. Specifically, Task 1 and Task 5 achieved strong final scores above 80%, indicating that these flows are generally clear and well-received by users. In contrast, Tasks 2, 3, and 4 received lower final scores, ranging between 54% and 68%, placing them within the marginal acceptability range. According to the SUS acceptability scale (Suresh Kumar Unnikrishnan, 2024), scores above 70 are considered acceptable, while scores between 50 and 70 are regarded as marginal. This suggests that several aspects of the interface still require refinement to meet a higher usability standard.

The results point to specific areas in need of improvement. One recurring issue was the visual similarity between the custom route buttons in both the recommended trail section and the Explore interface. Participants found it difficult to differentiate between the two, indicating a need to revise the icons or textual labels to enhance clarity. Additionally, users expressed confusion about switching between the Trail and Map modes within the Explore section, highlighting the necessity of an onboarding interface that actively guides new users through the core functionalities. Furthermore, the absence of instructional prompts in the custom route feature created uncertainty about how to proceed, suggesting that guidance should be included to facilitate user understanding.

To enhance the overall usability of the system in future development, the high-fidelity prototype should prioritise improvements in visual clarity and feature discoverability. Particular attention should be given to providing intuitive onboarding support that helps users engage confidently with both basic and advanced features. By addressing these issues, the system can offer a smoother and more accessible experience, ultimately supporting users in completing nature-related activities more effectively.

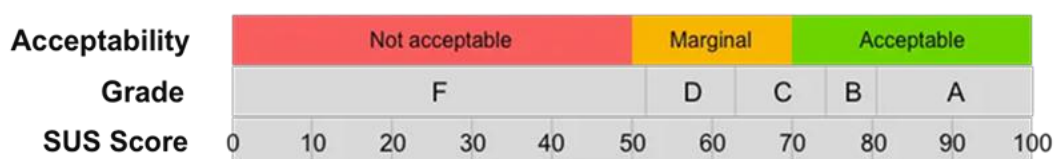


Figure 22. SUS Acceptability Scale

## 4.2. Feedback Testing

Following the completion of the mid-fidelity prototype, a round of usability testing was conducted with five anonymous participants to evaluate the functionality and intuitiveness of the nature exploration and biodiversity tracking app. All participants successfully completed the assigned tasks and provided detailed feedback on the navigation, collection features, and information clarity. The majority highlighted appreciation for features like species collection, map-based trail customization, and activity logging. Suggestions for improvement included clearer labels, onboarding support, and improved access to activity history.

This approach aligns with Nielsen and Landauer’s (1993) principle that testing with five users can uncover the majority of usability issues due to diminishing returns. Overall, participants found the interaction flow natural and engaging, with several noting that the app enhanced their sense of connection to nature. These findings support the app’s design goals of promoting meaningful outdoor experiences through context-aware biodiversity education and intuitive route navigation..

Participant ID	Task Completion	Overall Flow Feedback
P1	Yes	The user found the overall experience good but suggested adding an onboarding tutorial, especially to help switch between the two modes in the Explore section.
P2	Yes	<ol style="list-style-type: none"> <li>1. Liked the Species and Collection features.</li> <li>2. Wanted clearer indicators in Trail Info for interactive map elements.</li> <li>3. Suggested better guidance or prompts when pausing and finishing an activity.</li> </ol>
P3	Yes	<ol style="list-style-type: none"> <li>1. Appreciated the intuitive experience of viewing and starting a trail.</li> <li>2. Suggested clearer guidance for returning to previously viewed trails.</li> <li>3. Noted that the Explore label may be confusing, and recommended using "Nearby" instead.</li> </ol>
P4	Yes	<ol style="list-style-type: none"> <li>1. Liked the Navigate feature and found it helpful to start nature-related activities.</li> <li>2. Suggested improving the visual clarity and layout of the Map and Trail tabs.</li> </ol>
P5	Yes	<ol style="list-style-type: none"> <li>1. Enjoyed the activity tracking feature and ability to log encounters.</li> <li>2. Suggested that the Navigate button could lead to Activity History.</li> <li>3. Recommended highlighting the environmental overview more clearly.</li> <li>4. Suggested adding a clickable dropdown icon in the Summary section for better discoverability of expandable content.</li> </ol>

**Table 11.** Feedback Testing Result Table

The feedback collected from the mid-fidelity usability testing provided detailed and actionable insights for refining the high-fidelity prototype. While all participants successfully completed the assigned tasks and responded positively to the overall interaction flow, their qualitative feedback highlighted key areas for improvement. Users generally appreciated core features such as species collection, custom route creation, and activity tracking, which were perceived as engaging and relevant to the app's purpose.

However, several participants encountered challenges related to interface clarity and feature discoverability. Multiple users indicated confusion when switching between the Trail and Map modes in the Explore section, suggesting the need for an onboarding tutorial to guide new users through the two distinct modes. Additionally, participants expressed a desire for more precise visual indicators and clearer labeling in the Trail Info and Map interfaces to support better navigation and task completion. The similarity between icons or buttons for different route functionalities was also noted, calling for visual differentiation to avoid misinterpretation.

Furthermore, suggestions were made to improve the visibility and accessibility of key system features. For instance, participants recommended that the Navigate button more explicitly link to the Activity History, and that summary sections include a clickable dropdown icon to reveal detailed content. The environmental overview, although positively received, was considered insufficiently prominent in its current placement.

In response to these findings, the next iteration of the design will focus on enhancing user onboarding, refining visual hierarchy and labeling, and integrating contextual prompts throughout the interface. These adjustments aim to support intuitive interaction, reduce cognitive load, and ensure that both novice and returning users can efficiently navigate and benefit from the app's full range of features..

## 5. Think

### 5.1. Final User Flow

The final user flow was revised based on feedback obtained from the mid-fidelity usability testing, with the aim of enhancing navigational clarity, and feature discoverability. New interaction points are marked in orange within the diagram.

At the beginning of the experience, an onboarding tutorial has been added to introduce first-time users to the app's core functionalities. This is followed by a mode selection step, which clearly separates Trail Mode and Map Mode, addressing earlier confusion between these two exploration paths.

After route selection, both modes converge into the activity session, where several refinements have been made. Participants can perform species recognition during the activity, and upon completion, they are directed to an improved activity summary view. New options include saving or rating the trail and accessing their activity history from the Navigate interface.

Finally, the flow concludes with access to the profile section. These updates aim to create a more seamless and intuitive experience, supporting both independent discovery and reflective learning within the nature exploration context.

A high-resolution version is available at the following link:

[https://kingstonuniversity-my.sharepoint.com/:i:/g/personal/k2438742\\_kingston\\_ac\\_uk/EaFDiFp45dVLo6VBVaB81cwBRTXBO-n-ghwUUDVG4-Y9Lw?e=2H8xkZ](https://kingstonuniversity-my.sharepoint.com/:i:/g/personal/k2438742_kingston_ac_uk/EaFDiFp45dVLo6VBVaB81cwBRTXBO-n-ghwUUDVG4-Y9Lw?e=2H8xkZ)

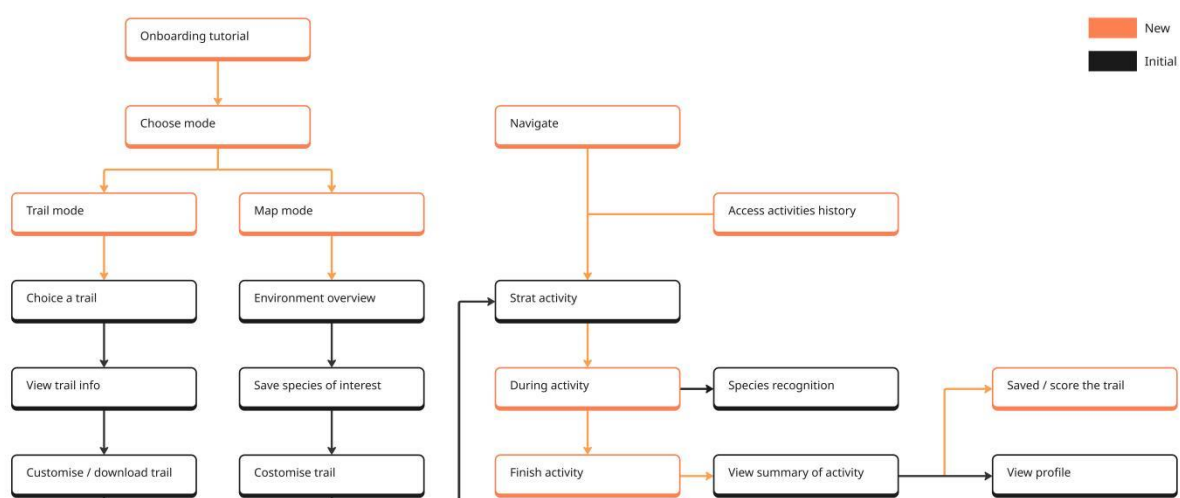


Figure 23. Final User Flow

## 5.2. Final Information Architecture

The final information architecture was refined based on insights gathered from mid-fidelity usability testing. Key structural elements were retained to preserve the original user flow, while several new functions were added to enhance clarity, discoverability, and task support across core sections.

In the Explore section, the system now explicitly separates the Map and Trail modes, aligning with the revised user flow. The Navigate section was expanded with a new way to add a trail from activity history, enhancing post-activity engagement and reflecting users' desire to review and evaluate their own progress.

Overall, the architectural refinements improve system scalability and user experience by clearly organising functions while supporting new user needs discovered through iterative testing.

A high-resolution version is available at the following link: [https://kingstonuniversity-my.sharepoint.com/:i:/g/personal/k2438742\\_kingston\\_ac\\_uk/EQSpU1b7WEpFgIMHDzZrxhcBGYAVYY-jJtIsumiB54swA?e=CeQvfZ](https://kingstonuniversity-my.sharepoint.com/:i:/g/personal/k2438742_kingston_ac_uk/EQSpU1b7WEpFgIMHDzZrxhcBGYAVYY-jJtIsumiB54swA?e=CeQvfZ)

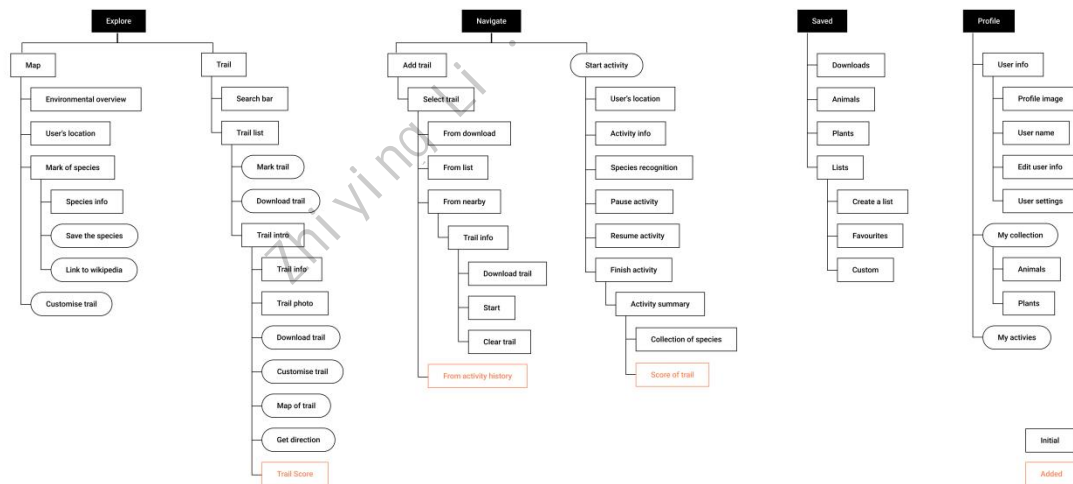
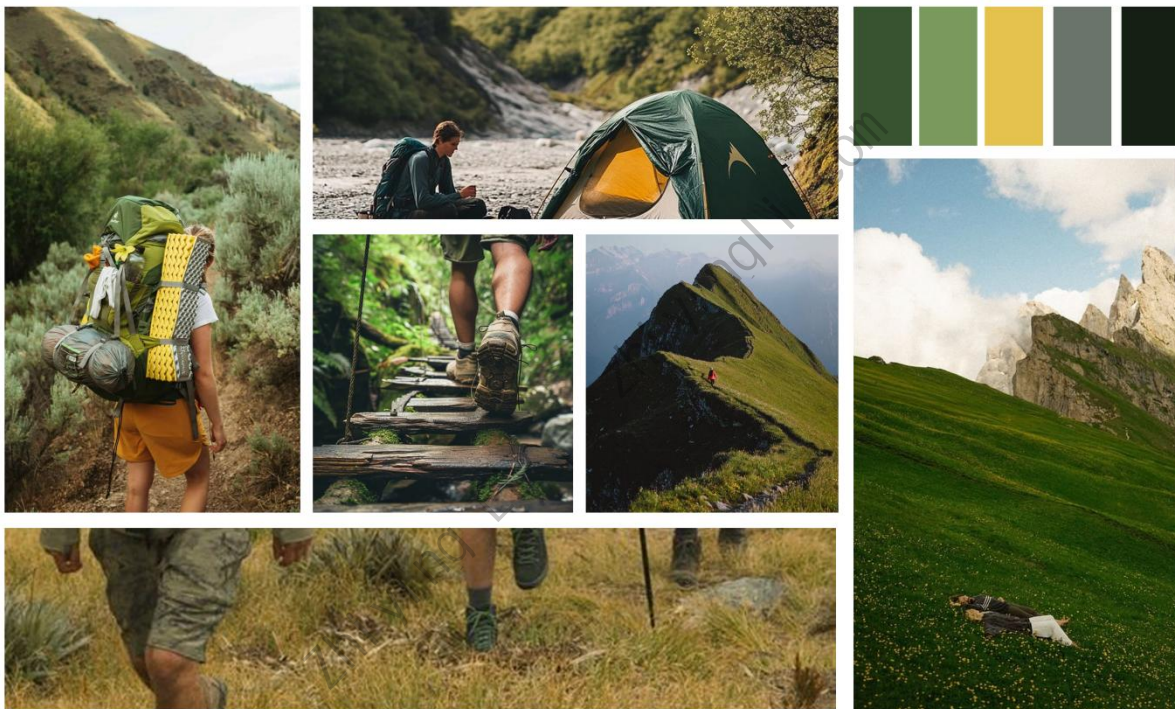


Figure 24. Final Information Architecture

## 6. Make

### 6.1. Mood Board

The mood board captures the emotional and visual tone of the proposed app by drawing inspiration from outdoor adventure, human – environment interaction and nature immersion. It emphasizes earthy and natural colour tones to evoke a sense of vitality, calm, and connection to nature. This visual direction not only reinforces the app’s functional goals of promoting outdoor activity and environmental awareness, but also informs the branding, UI aesthetics, and overall user experience.



**Figure 25.** Mood Board

From the mood board, a core colour palette was extracted to guide the visual identity of the application. This palette includes deep forest green, moss green, mustard yellow, soft beige, and charcoal grey. These colours were selected to reflect the natural environment and evoke feelings of trust, calmness, and exploration. The palette will form the foundation for the design system, influencing interface elements such as buttons, backgrounds, typography highlights, and system feedback. It also establishes a cohesive and emotionally resonant aesthetic that aligns with the app’s purpose of connecting users to nature through outdoor activity and environmental learning.

## 6.2. Design System and Style-Guide

### (1) Logo

The WildLoop logo integrates the application's three core elements: mountains, animals, and plants. A paw print represents the animal aspect, a leaf reflects biodiversity and environmental awareness, and a winding line symbolises mountainous trails. These elements are visually merged into a cohesive and minimalistic icon that communicates the essence of nature exploration and ecological discovery.

The colour palette is derived from the project's mood board, aligning with the emotional tone and brand identity. A charcoal grey background creates a sense of depth and calmness associated with nature, while the vivid yellow trail enhances contrast and visibility. This combination increases brand recognition and supports a clear, approachable visual identity suitable for outdoor and educational contexts.

A high-resolution version is available at the following link:

[https://kingstonuniversity-my.sharepoint.com/:i/g/personal/k2438742\\_kingston\\_ac\\_uk/EYcpjUUcNjFAtQ80eBrWjhlBpUY43ZxeHvdOUgaVNABByug?e=Vcxie5](https://kingstonuniversity-my.sharepoint.com/:i/g/personal/k2438742_kingston_ac_uk/EYcpjUUcNjFAtQ80eBrWjhlBpUY43ZxeHvdOUgaVNABByug?e=Vcxie5)



Figure 26. Logo

## (2) Branding

The branding of WildLoop is carefully crafted to reflect the app's core vision of enhancing outdoor experiences through environmental education. Its visual identity draws from natural elements including animal tracks, mountain forms, and plant shapes. These elements are transformed into simplified line-based motifs that symbolise exploration, biodiversity, and connection with nature.

The brand mission is to encourage users to connect with the environment through nature-based exploration. The vision focuses on creating an innovative platform that integrates outdoor activities with accessible environmental learning. Key brand values such as exploring, learning, sustainability, ease, and authenticity help shape a consistent visual and verbal identity. The overall branding builds emotional resonance while supporting user trust and engagement.

A high-resolution version is available at the following link:

[https://kingstonuniversity-my.sharepoint.com/:i:/g/personal/k2438742\\_kingston\\_ac\\_uk/Ef2kKsFhdCBEnNPwoVYy5NUBlqvcAC0PqCeWT4PEV35DNw?e=nCUVel](https://kingstonuniversity-my.sharepoint.com/:i:/g/personal/k2438742_kingston_ac_uk/Ef2kKsFhdCBEnNPwoVYy5NUBlqvcAC0PqCeWT4PEV35DNw?e=nCUVel)

### Pattern Creation



WildLoop's visual pattern is inspired by natural curves, plant shapes, and animal tracks. Simplified line motifs echo trails and biodiversity, reinforcing the app's theme of exploration.

PATTERN

FurniGo

**Encourage users to connect with the environment through nature-based exploration.**

### Brand Mission

Brand Mission

FurniGo

**Create an innovative platform that integrates outdoor experiences with environmental education.**

### Brand Vision

Brand Vision

FurniGo

Brand Values & Keywords



BRANDING

FurniGo

Figure 27. Branding

### (3) Colour Palette and Typography

The visual identity of WildLoop integrates a nature-inspired colour palette with the SF typeface, a system font specifically designed for iOS. The colour palette draws from the app’s mood board, incorporating shades of green, soft neutrals, and a warm accent tone to evoke a sense of nature, comfort, and curiosity. These colours help establish a calm yet engaging atmosphere that supports the app’s goal of promoting environmental learning and exploration.

The SF typeface offers high legibility and modern aesthetics, aligning with Apple’s design standards and ensuring a seamless visual experience across iOS devices. Its clean, geometric structure enhances readability in various screen sizes and usage contexts, contributing to a consistent and user-friendly interface. Together, the colour and typography choices strengthen WildLoop’s visual language and support its brand message.

A high-resolution version is available at the following link:

[https://kingstonuniversity-my.sharepoint.com/:i:/g/personal/k2438742\\_kingston\\_ac\\_uk/Ed1KCEfjnL9PsdR\\_76iwpD8BQ\\_MjHrvYzGSnkkPxt-NCTvQ?e=UGbXMs](https://kingstonuniversity-my.sharepoint.com/:i:/g/personal/k2438742_kingston_ac_uk/Ed1KCEfjnL9PsdR_76iwpD8BQ_MjHrvYzGSnkkPxt-NCTvQ?e=UGbXMs)

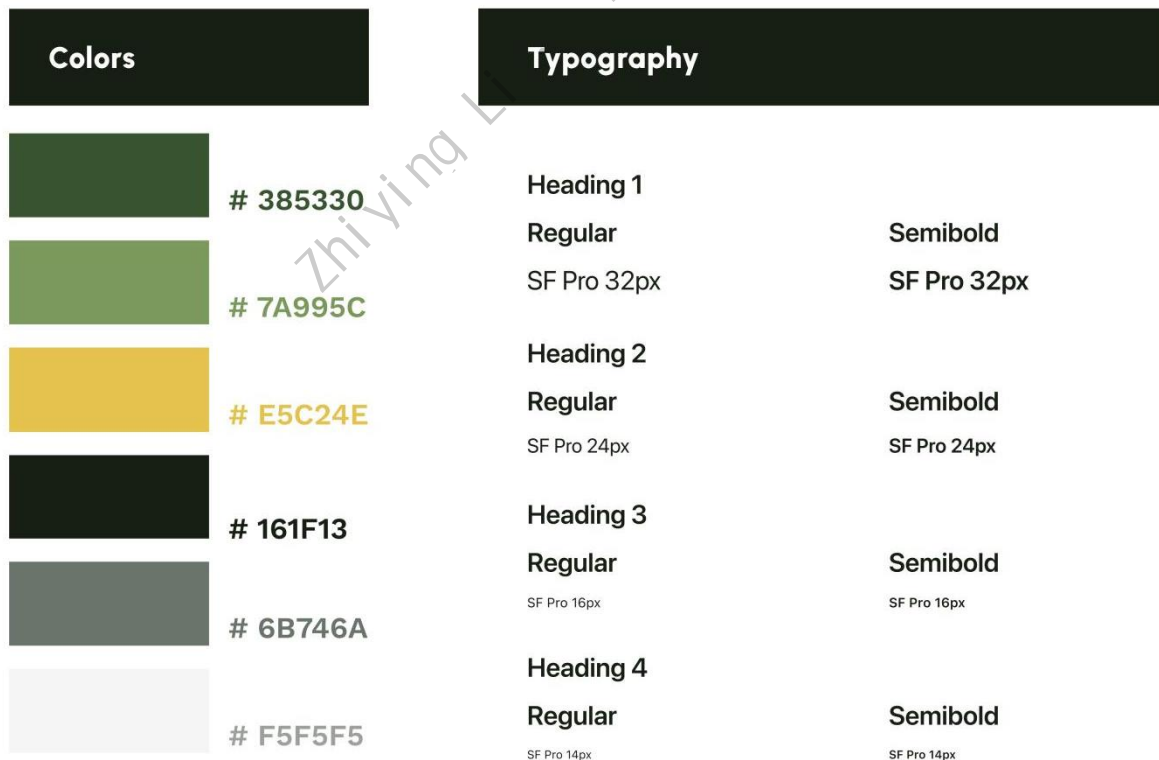


Figure 28. Colour Palette and Typography

#### (4) Iconography and Component Library

The iconography and component library in WildLoop are developed to support visual consistency and intuitive interaction across the interface. Icons are rendered in a clean line style, with selected custom designs such as paw prints, plant leaves, and trail paths to reflect the app's outdoor and nature-education focus. Common functional icons such as download, bookmark, and navigation arrows are also included to ensure usability and clarity.

The component library includes reusable elements such as buttons, toggles, navigation tabs, and map markers. Buttons are designed with clear labels and contrast, using filled or outlined styles depending on their function. Special icons and colours are used to distinguish map modes, waypoint categories, and trail states. The bottom navigation bar follows iOS conventions, and active tabs are visually highlighted using both icon colour and underline. This systematic design approach enhances both visual harmony and user efficiency throughout the app.

A high-resolution version is available at the following link:

[https://kingstonuniversity-my.sharepoint.com/:i:/g/personal/k2438742\\_kingston\\_ac\\_uk/EZ5YFI9CxQFKmpx-aG68js8B9RK6dpL6Wq8mbgFsE-efMQ?e=2Bg2UK](https://kingstonuniversity-my.sharepoint.com/:i:/g/personal/k2438742_kingston_ac_uk/EZ5YFI9CxQFKmpx-aG68js8B9RK6dpL6Wq8mbgFsE-efMQ?e=2Bg2UK)

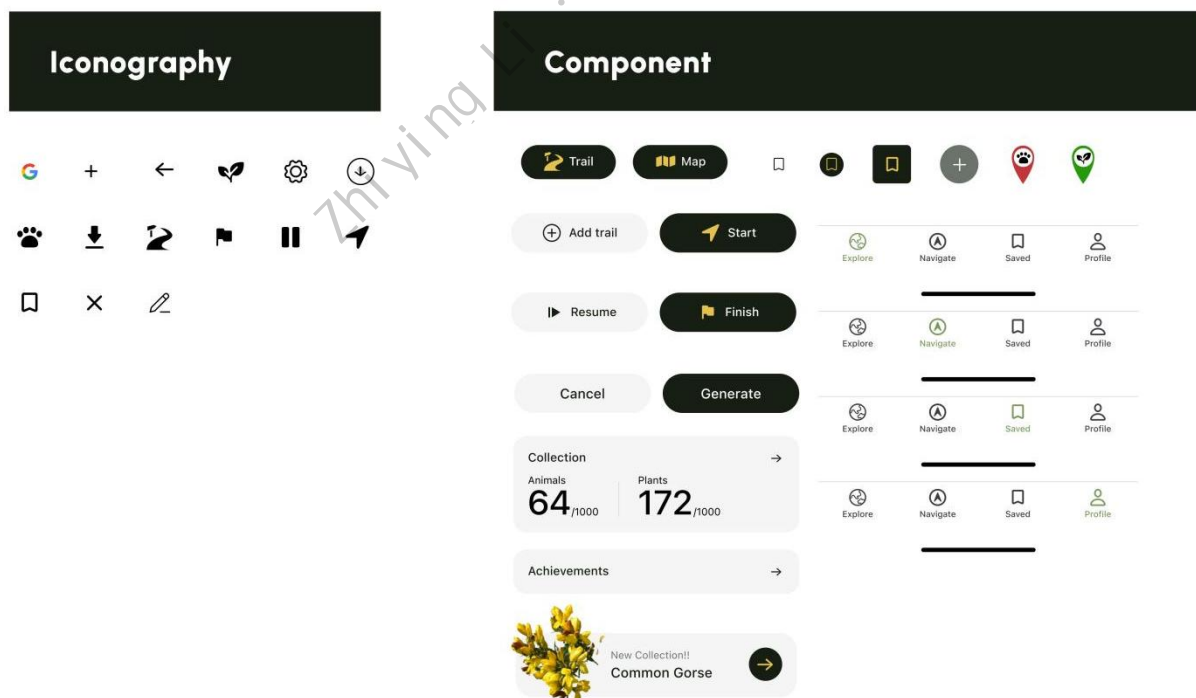


Figure 29. Iconography and Component Library

### 6.3. Hi-fi Prototype

The high-fidelity prototype was designed based on the structure and feedback from the mid-fidelity version, as well as the results of the usability testing. This version aimed to refine the user experience by incorporating more detailed visual elements and clearer interaction flows. A consistent design system was applied, including a defined colour palette, typography, icons, and layout principles, to ensure visual clarity and functional consistency.

The prototype retained the main structure established in the mid-fidelity design, while improving areas identified as less effective during earlier testing. For example, key buttons were redesigned using high-contrast colours such as black and yellow to make primary actions more noticeable. This helped reduce confusion and improved users' ability to complete tasks independently. In addition, onboarding screens were introduced at the beginning to help new users quickly understand the app's main functions and navigate the interface with greater ease.

This high-fidelity version serves as a more realistic representation of the intended user experience. It provides a strong foundation for further evaluation through feedback testing and supports future refinement of both interaction and visual design.

A high-resolution version is available at the following link:

[https://kingstonuniversity-my.sharepoint.com/:i:/g/personal/k2438742\\_kingston\\_ac\\_uk/EQ-VOdxM-UZMmlw\\_y2QZxEwBXuW2e4-K6qY87LHpFEr2Q?e=bG3EkX](https://kingstonuniversity-my.sharepoint.com/:i:/g/personal/k2438742_kingston_ac_uk/EQ-VOdxM-UZMmlw_y2QZxEwBXuW2e4-K6qY87LHpFEr2Q?e=bG3EkX)

A clickable Figma prototype is available at the following link:

<https://www.figma.com/proto/3X1UaS6hAgW1OuYFzr1y7P/Final?node-id=5-2&p=f&t=pKw3y6Pd6GCDYrVK-0&scaling=scale-down&content-scaling=fixed&starting-point-node-id=356%3A4878&show-proto-sidebar=1>

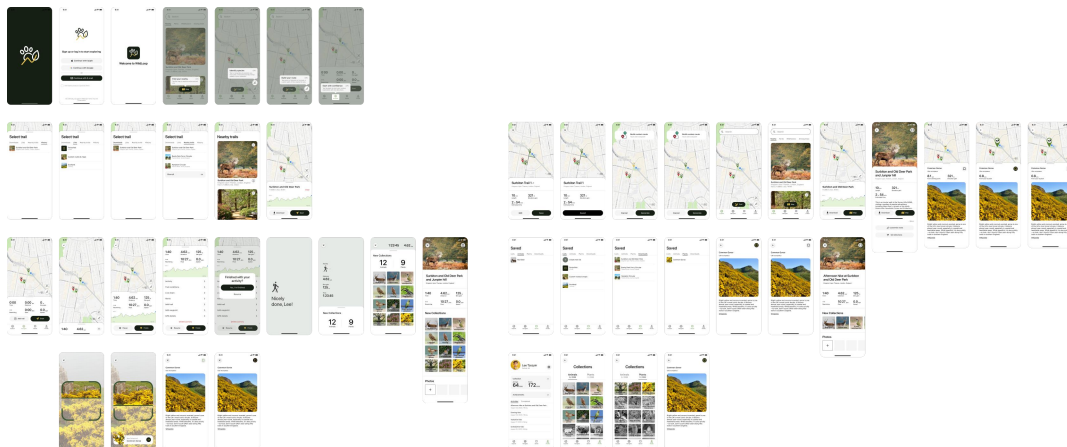


Figure 30. Hi-fi prototype

The following section outlines the core functionalities of the application, providing an overview of each main interface and its purpose:

### **Onboarding Section**

After logging in or signing up, users are introduced to four key features: switching between the map and trail views in the Explore section, using the species recognition tool, creating custom routes, and starting an activity recording.

### **Explore – Trail Section**

This section allows users to browse system-recommended trails or search for specific locations to find suggested routes. By selecting a trail, users can view detailed information, including descriptions, route maps, and options to download or mark the trail.

### **Explore – Map Section**

Users can explore nearby green spaces and species based on their current location. The map displays points of interest, including animals and plants. A custom route can be generated by selecting species the user wishes to encounter, supporting personalised nature exploration.

### **Navigate Section**

This section allows users to record their activities. Users can either start tracking directly, which generates a route based on their movements, or select a route from downloads, saved lists, nearby options, or past activities. During the activity, users can collect plant and animal cards using the species recognition tool. At the end, a summary is provided showing route details and species encountered.

### **Saved Section**

Users can view and manage saved or downloaded trails, including their own custom routes. Collected species are also stored here for easy access.

### **Profile Section**

Users can view their collected species and review past activity records.

## 7. Check

### 7.1. Usability Testing

The high-fidelity usability testing followed the same scoring methodology as the mid-fidelity phase. Task performance was assessed using a weighted scoring model that factored in average time, errors, and assistance levels per task. This allowed for consistent benchmarking across both stages and enabled a fair comparison of user performance as the design matured. By applying the same evaluation criteria, we ensured continuity in measurement and focused on identifying any significant changes in usability or user behavior resulting from the refined interface.

The five hypothesis-driven tasks and their corresponding feature testing goals are outlined in Table 13 below, providing a structured basis for evaluating usability across the app's core functions.

Hypothesis	Usability Test according to Hypothesis Statement
H1	Select a nearby trail on the homepage to view brief trail information and illustrations, and find a plant of the trail on the map.
H2	Find and save the closest plant from the map around your current location.
H3	Use the personalised route feature by clicking on the all species in the exploring map, generate a custom route, and save it.
H4	Record your activities. During the activity, use the species recognition feature once to identify a plant or animal you encounter. After completing the activity, view the summary to see which species you encountered.
H5	Go to your Profile page. Review the plant and animal species you've collected and the routes you've completed. Tap on one species card to view its detailed information.

**Table 12.** Usability Task Table

### (1) Hypothesis One

This task required participants to select a nearby trail from the homepage and view its brief information, including illustrations of flora and fauna. Participants were also expected to interact with biodiversity icons on the trail map to simulate a basic exploration experience.

Participant ID	Time	Number of Errors	Number of Assists	Result
P6	18 Sec	0	0	Pass
P7	10 Sec	0	0	Pass
P8	15 Sec	0	0	Pass
P9	13 Sec	0	0	Pass
P10	16 Sec	0	0	Pass
Average	14.4 Sec	0	0	
Score	0.84	1	1	
Final Score	92.00%			

**Table 13.** Task Result Table 6

### (2) Hypothesis Two

Participants were instructed to navigate the map around their current location to find and save the closest plant. This task tested the discoverability and functionality of the interactive map and save feature.

Participant ID	Time	Number of Errors	Number of Assists	Result
P6	26 Sec	0	0	Pass
P7	6 Sec	0	0	Pass
P8	5 Sec	0	0	Pass
P9	50 Sec	0	0	Pass
P10	3 Sec	0	0	Pass
Average	18 Sec	0	0	
Score	0.8	1	1	
Final Score	90.00%			

**Table 14.** Task Result Table 7

### (3) Hypothesis Three

This task focused on using the personalised route generation feature. Participants were asked to select species they had previously saved, use them to generate a custom trail, and add the route to their favourites. It tested cross-feature navigation and user flow clarity.

Participant ID	Time	Number of Errors	Number of Assists	Result
P6	16 Sec	0	0	Pass
P7	20 Sec	0	0	Pass
P8	15 Sec	0	0	Pass
P9	35 Sec	0	0	Pass
P10	40 Sec	0	0	Pass
Average	25.2 Sec	0	0	
Score	0.72	1	1	
Final Score	86.00%			

**Table 15.** Task Result Table 8

### (4) Hypothesis Four

Participants were asked to start and record an activity, use the species recognition function during the journey, and then finish the session to review the summary of encountered species. This task tested the in-activity features and end-of-activity feedback.

Participant ID	Time	Number of Errors	Number of Assists	Result
P6	31 Sec	0	0	Pass
P7	50 Sec	0	1	Pass
P8	35 Sec	0	0	Pass
P9	27 Sec	0	0	Pass
P10	40 Sec	0	0	Pass
Average	36.6 Sec	0	0.2	
Score	0.5933	1	0.8	
Final Score	74.67%			

**Table 16.** Task Result Table 9

### (5) Hypothesis Five

The final task directed participants to the profile page, where they reviewed the plants and animals collected, as well as completed routes. They were expected to tap on a species card to view its detailed information, testing the content organisation.

Participant ID	Time	Number of Errors	Number of Assists	Result
P6	18 Sec	0	0	Pass
P7	20 Sec	0	0	Pass
P8	15 Sec	0	0	Pass
P9	15 Sec	0	0	Pass
P10	11 Sec	0	0	Pass
Average	15.8 Sec	0	0	
Score	0.8244	1	1	
Final Score	91.22%			

Table 17. Task Result Table 10

### (6) Conclusion

All five participants successfully completed all assigned tasks, resulting in an average final usability score of 86.38%. This outcome indicates that the high-fidelity prototype performed well in terms of usability.

Compared with the first round of testing based on the mid-fidelity prototype, this round showed significant improvements in both task completion time and the number of assists required. Two main factors likely contributed to these improvements. First, the high-fidelity design allowed for greater use of colour and visual detail. In particular, key action buttons were designed using high-contrast colours such as black and yellow, making it easier for users to identify the main button and complete tasks efficiently. Second, based on insights from the previous testing, an onboarding interface was added to the high-fidelity version. This helped users become familiar with the app's core features and supported quicker learning and navigation during the test.

## 7.2. Feedback Testing

Following the high-fidelity usability testing, a qualitative feedback session was conducted to gather in-depth user impressions and suggestions for further refinement. Five participants were invited to explore the key features of the prototype and share their opinions based on their interactions. The objective of this session was to better understand users' emotional responses, identify potential usability concerns that may not have emerged during task-based testing, and collect ideas for feature enhancement and future iterations. Each participant was encouraged to provide open-ended feedback regarding design clarity, functionality, and overall experience.

Participant ID	Task Completion	8. Overall Flow Feedback
P6	Yes	<ol style="list-style-type: none"> <li>1. The save button is very clear, which helps me complete the task easily.</li> <li>2. For the custom route feature, I hope future versions allow users to manually sort waypoints by clicking.</li> <li>3. I like the scan recognition page, which feels lively.</li> <li>4. For the saved species page, I suggest adding tags such as "collected" or "not collected" to each item.</li> </ol>
P7	Yes	<ol style="list-style-type: none"> <li>1. I like the route recording and activity photo features.</li> <li>2. It would be great to add a rating system for routes to help filter them more easily.</li> <li>3. I also hope uploaded photos can be displayed under the route info for others to reference.</li> </ol>
P8	Yes	<ol style="list-style-type: none"> <li>1. I like the custom route planning function. Nature-based routes motivate me to exercise more.</li> <li>2. Currently, species can only be collected by scanning. For fast-moving animals like squirrels or foxes, this might be difficult. I suggest adding a manual entry option for species.</li> </ol>
P9	Yes	<ol style="list-style-type: none"> <li>1. I like the system-recommended preset routes. I also hope the map can display explored and unexplored routes or areas.</li> <li>2. I suggest saving photos taken during species recognition for memory and review.</li> </ol>
P10	Yes	<ol style="list-style-type: none"> <li>5. I enjoy the species recognition function and learning facts about them. Compared to Google Lens, this app looks cleaner and more beautiful.</li> <li>6. It feels like a mix between a travel guide and a nature teacher. I would love to see a community feature added to share posts, and digital badges to motivate exploration, especially if they can be shared with friends.</li> </ol>

**Table 18.** Feedback Testing Result Table

The feedback collected revealed several recurring themes and valuable suggestions. Most participants appreciated the visual clarity of interactive elements, particularly the visibility of the save button and the use of colour to distinguish primary actions. The scan-to-identify feature was described as engaging and visually appealing. Users expressed interest in expanding the functionality of both species collection and route planning. For instance, some participants recommended adding manual input for species that are difficult to scan in real time, such as fast-moving animals. There were also requests for more personalized control over custom routes, including the ability to manually reorder waypoints.

In addition, participants suggested enhancing social and motivational features, such as route rating, digital badges, and community sharing. The idea of tagging species as “collected” or “not collected” was viewed as a helpful way to track exploration progress. Others appreciated the potential for preserving route memories by integrating user-uploaded photos into the trail information section. Overall, the feedback confirmed strong user interest in the app's concept and direction, while highlighting opportunities to support deeper engagement through more customization, memory-building features, and social interaction elements.

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## **5. Discussion and Conclusion**

### **5.1. Key Findings**

#### **(1) User Behaviour Insights**

Currently, users rely mainly on outdoor activity apps or navigation tools when engaging in outdoor activities. For nature exploration, they often depend on word-of-mouth information or single-purpose plant and animal identification apps. However, there is a lack of integrated products that combine outdoor activity with nature exploration. Such a gap limits users' opportunities to develop deeper interactions with the natural environment during their outdoor experiences. As a result, it may hinder the promotion of a healthy lifestyle and the cultivation of ecological awareness.

#### **(2) Design Preferences**

User behaviours in this context can be broadly categorised into two types: engaging in outdoor activities and exploring nature. In terms of nature exploration, users tend to prefer content that is not overly serious or information-heavy. They show a clear preference for playful, flexible learning experiences. To meet this preference, the product adopts a gamified learning approach that allows users to collect and identify plants and animals, making the learning process more enjoyable and motivating.

Regarding outdoor activities, users express a desire to explore routes that match their personal interests. To address this, the design provides a set of pre-designed routes for users to choose from, while also allowing them to create customised routes by selecting specific checkpoints along the way. This dual approach supports both guided and self-directed exploration.

#### **(3) Design Principle**

To support user engagement without causing cognitive overload, the interface adopts a minimalist design approach. Visual elements are intentionally kept clean and straightforward, allowing users to focus on exploration rather than being distracted by unnecessary information.

Additionally, the information is layered and contextual. Instead of overwhelming users with dense scientific content upfront, the system provides brief, accessible descriptions and allows users to delve deeper only when interested. This approach ensures that learning remains optional, non-intrusive, and aligned with the gamified and flexible nature of the experience.

Together, these design principles aim to create a lightweight, intuitive interface that encourages continuous interaction while respecting users' pace, motivation, and preferences in both outdoor activity and nature learning.

## **5.2. Challenges and Solutions**

The first major challenge of this project was how to effectively integrate the two core functions of outdoor activity and nature education. It was important to combine these elements without overwhelming users with complex or excessive information. To address this, interviews were conducted with nature-loving outdoor enthusiasts to explore what tools they currently use to engage with nature during their activities, and what limitations these tools have. By analysing their feedback, I was able to identify the strengths and weaknesses of existing solutions and clarify the positioning of my own product. Subsequent usability testing helped to evaluate how users responded to the integration of these functions.

The second challenge was encouraging users to engage with and enjoy the nature education component. To solve this, all nature-related content in the app was made optional. This allows users who simply want to enjoy nature quietly, without educational input, to still benefit from features like route planning, activity summaries, and safety guidance. For users interested in deeper exploration, the app supports route planning based on specific species of interest. During the activity, users can use the species identification function to learn and collect nature cards, without adding cognitive burden.

These solutions ensured a balance between educational value and user autonomy. By making content optional and designing features around real user behaviour, the app successfully integrates outdoor activity with nature learning in a way that is both flexible and meaningful.

## **5.3. Future Work**

Future development of the app will focus on enhancing user engagement and promoting long-term use. First, the app could introduce digital achievement systems to encourage users to explore nature in a more playful and motivating way. These gamified elements can help sustain user interest and increase the frequency of nature-based interactions.

Second, to improve the app's shareability and user loyalty, future iterations could integrate community-based features. These may include collaborative route editing, the ability to share achievements with others, team-based exploration modes, and

photo-sharing boards for documenting natural discoveries. Such features aim to foster a sense of belonging and social connection among users with shared interests.

Finally, to further improve the app's professional value, especially for different types of outdoor activities such as walking, hiking, or cycling, the summary function could be expanded. More tailored post-activity feedback could be generated based on activity type, helping users gain deeper insight into their outdoor behaviour and encouraging continued engagement.

In addition, future versions could incorporate a broader set of environmental indicators to support more immersive and context-aware outdoor experiences. Features such as scenic checkpoints, tree density maps, shading coverage, acoustic conditions, and visual landscape diversity could be integrated into both route planning and real-time navigation. These elements, informed by environmental psychology research, may further enhance users' sensory comfort and emotional connection with nature, encouraging deeper and more frequent engagement.

#### **5.4. Conclusion**

This project aimed to design a mobile application that integrates outdoor activity with nature education, enabling users to enhance both physical well-being and ecological awareness through exploration. Through user research and iterative prototyping, the project demonstrated the feasibility of combining nature-based learning with route planning. The final design adopted a lightweight, optional, and gamified approach, which was well-received in usability testing, especially in terms of motivating nature interaction and improving environmental understanding.

By addressing the gap between outdoor activity tools and nature education products, the project contributes a practical model for designing engaging, purpose-driven digital experiences. In future, the application could be extended to educational or community settings to support broader, cross-context engagement.

Overall, this work repositions nature exploration as an accessible, enjoyable, and meaningful activity, aligning user motivation with environmental values in a balanced, user-centered way.

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# Appendices

## Appendix 1 Raw Data

Appendix Folder:

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## Study 1 Interview

Interview Folder:

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Ethics Consent Forms:

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Ethics Documents:

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Transcripts:

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## Study 2 Mid-fi Prototype Testing

Mid-fi Prototype Testing Folder:

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### **Study 3 Hi-fi Prototype Testing**

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## **Appendix 2 Artefacts**

Appendix Folder:

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## **Stage 1 Think**

Appendix Folder:

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## **Stage 2 Make**

Appendix Folder:

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## **Stage 4 Think**

Appendix Folder:

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## **Stage 5 Make**

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## **Appendix 3 Prototypes**

Appendix Folder:

### **Prototype1 Mid-fi Prototype**

Mid-fi Prototype Folder:

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Prototype PDF:

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Link of Figma:

<https://www.figma.com/proto/3X1UaS6hAgW1OuYFzr1y7P/Final?node-id=91-4400&p=f&t=rtBQWifRR4OEUTba-0&scaling=scale-down&content-scaling=fixed&starting-point-node-id=91%3A4401>

### **Prototype 2 Hi-fi Prototype**

Hi-fi Prototype Folder:

Prototype PDF:

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Link of Figma:

<https://www.figma.com/proto/3X1UaS6hAgW1OuYFzr1y7P/Final?node-id=5-2&p=f&t=rtBQWifRR4OEUTba-0&scaling=scale-down&content-scaling=fixed&starting-point-node-id=356%3A4878&show-proto-sidebar=1>

Walkthrough Video:

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## **Appendix 4 Submission of Project**

Project Folder:

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Ethics Form:

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Report:

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