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COMP 4200 - Introduction To Graduation Project

Project Proposal

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Gamified Smart Agricultural Nursery

Section Number: 24

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Abstract

In response to the increasing demand for digital solutions in plant care and nursery management, the Smart Agriculture Nursery Application brings traditional plant nurseries into the digital age by simplifying plant care, enhancing user engagement, and improving operational efficiency for nurseries. Through an examination of existing apps, we identified key areas for improvement and developed a mobile platform that empowers users to manage plant care, shop for supplies, and connect with a like-minded community of plant enthusiasts.

The app provides personalized reminders and tips tailored to each user's plant needs, helping users keep their plants healthy. Users can also earn points for purchases and logging plant care activities, which can be redeemed for fun rewards and badges, making plant care more enjoyable. Additionally, an online store allows users to easily shop for plants, tools, soil, and other supplies. For nursery staff, the app includes tools to manage inventory, track orders, and streamline the shopping experience, allowing nurseries to serve their customers more effectively.

Built using the Scrum methodology, our app was developed in stages, allowing for regular feedback and continuous improvement to meet user needs. This easy-to-use, feature-rich app combines smart technology and community interaction to make plant care more engaging for users, while helping nurseries run more efficiently and provide a better experience for their customers.

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Table 1: app comparison table

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Chapter 1: Introduction

- This proposal is divided into three chapters. In this chapter, we will introduce the overview, as well as our aims and objectives. Chapter two covers the project's background and similar related apps. Chapter Three will discuss our approach, methodology, resources, and ethical considerations.

1.1 Overview

The challenge is to modernize traditional plant nurseries, making them more accessible, engaging, and efficient for both users and administrators. Many users face difficulties in caring for their plants due to a lack of knowledge, while nurseries struggle to manage their inventory, engage customers, and offer personalized services effectively. To address these challenges, an innovative solution is to develop a smart, gamified inventory management system that enhances both the user and administrative experience.

For clients, the system will provide digital tools to manage their personal plant inventory, offering real-time updates on plant care. Users will receive personalized care advice based on the types of plants they own, their preferences, and local conditions such as weather. This system will also include notifications to remind users when to water, prune, or fertilize their plants, helping them overcome common challenges related to plant care. A community-driven approach will allow users to interact with others who share similar interests, offering and receiving advice, which earns them points. In addition, an integrated e-commerce feature will enable users to shop for plants, tools, soil, and fertilizers. The system's recommendations will be tailored not only to the users' preferences and location but also to health considerations, such as allergies.

On the administrative side, the platform will provide an e-commerce system for managing orders, and inventory. Administrators will have access to search and filtering tools that offer personalized shopping experiences to users based on their preferences. They will be able to efficiently manage inventory, track orders, and handle reservations for plants and tools, as well as manage gifts and special offers to boost customer engagement. The system will simplify the workflow for administrators, allowing them to focus on providing a better overall customer

experience.

A key feature of this system is gamification, which makes plant care more fun and engaging for users. Each time a user purchases a plant or related item, they will earn points. Special badges or rewards are unlocked when users buy specific plants or reach certain milestones. Points and scores will be visible only to the individual users, allowing them to track their progress privately. As users reach higher scores, they will unlock additional rewards, encouraging a sense of accomplishment. The system fosters collaboration by motivating users to share tips, exchange experiences, and support each other in their plant care journeys through community forums, ensuring a focus on mutual growth and support.

This enhanced gamified smart nursery system will transform the traditional nursery experience by combining advanced technology, personalized care, and community-driven interaction. By making plant care easier and more engaging for users, and simplifying inventory and customer management for administrators, the system will improve the efficiency and appeal of plant nurseries overall.

1.2 Aim and Objectives

- Aim:

The primary aim of the Smart Agriculture Nursery Application is to modernize plant nurseries by creating a digital platform that simplifies plant care, improves user engagement, and enhances the operational efficiency of nurseries. This platform will serve as an all-in-one solution for both plant enthusiasts and nursery administrators, incorporating personalized plant care, e-commerce features, and community engagement through a gamified system.

- Objectives:

1. Enhance Personalized Plant Care for Users:

- Develop a personalized plant care system that provides tailored advice based on user preferences, specific plant types, local environmental conditions.
- Send timely reminders and notifications for essential tasks, such as watering, pruning, and fertilizing, to help users maintain healthy plants.

2. Increase User Engagement Through Gamification:

- Implement a gamified system with points, rewards, badges, and milestones to encourage active participation in plant care, shopping, and community engagement.
- Recognize users' achievements to make plant care enjoyable and rewarding.

3. Foster a Community-Driven Experience:

- Enable user interactions in community groups where plant care tips and advice can be shared, promoting knowledge sharing and mutual support among users.

4. Integrate E-Commerce Functionality with Personalized Recommendations:

- Offer an online store where users can purchase plants, and other gardening supplies.
- Tailor shopping recommendations to user preferences, location, and health

considerations like allergies or pet-safe plant options for a more relevant shopping experience.

Chapter 2: Background, Literature Review And Similar Related Apps.

2.1 Background

The Smart Agriculture Nursery Application is designed to modernize plant nurseries with a digital platform that makes plant care simpler, enhances user engagement, and streamlines nursery operations. Our platform serves both plant enthusiasts and nursery managers, offering tailored plant care guidance, e-commerce options, and a community-focused experience. It addresses the growing need for digital solutions in agriculture, making plant care more accessible and enjoyable while optimizing business processes.

To achieve these goals, we carefully chose a technology stack that prioritizes cross-platform compatibility, reliability, and a seamless user experience. **Flutter** [1] is our choice for frontend development, enabling efficient cross-platform app deployment on iOS and Android with a single codebase. This approach reduces development time and ensures a consistent experience across devices. Material Design components further refine the interface, ensuring an intuitive and visually engaging layout that aligns with user expectations.

For the backend, **Spring Boot** [2] was selected to develop RESTful APIs and manage backend operations due to its scalability and efficiency in handling complex tasks, such as personalized reminders and data management. We chose **PostgreSQL** [3] [4] as our database for its strength in supporting complex queries, essential for managing user data, plant inventory, and transaction records securely and reliably.

Firebase [5] [6] supports our cloud services, providing real-time database capabilities, secure user authentication, and hosting. This integration enables dynamic updates and ensures users receive immediate responses. With **Firebase Cloud Messaging** [7] (FCM) we deliver timely push notifications for essential plant care tasks, keeping users informed and engaged.

To enhance personalization, we integrate additional APIs, such as a **Weather API** [8] which allows us to provide real-time weather data for location-based plant care reminders.

Our development workflow is anchored by tools like **Visual Studio Code** [9] for Flutter development and Postman for API testing, ensuring smooth backend integration. **GitHub** [10] serves as our version control system, facilitating team collaboration and maintaining an organized development history.

To manage tasks and keep our roadmap organized, we rely on **Notion** [11]. This versatile workspace allows us to assign, track, and manage tasks collaboratively, ensuring everyone stays aligned with milestones and responsibilities. With customizable boards in Notion, we maintain a clear roadmap of upcoming features, ongoing bug fixes, and user feedback integration, which helps keep the project on track and supports transparent communication. Centralizing our documentation and planning in Notion streamlines collaboration and is essential for achieving the project's goals in an organized and timely way.

For streamlined team communication, **Google Meet** [12] provides reliable video conferencing and screen-sharing features. Using Google Meet, our team can hold regular check-ins, collaborate in real time, and quickly resolve issues, regardless of location. Its integration with Google Workspace also simplifies scheduling, document sharing, and follow-ups through **Google Calendar and Drive** [13] [14]. This setup enhances our remote or hybrid work environment by enabling quick communication and maintaining alignment across project phases.

This technology stack empowers the Smart Agriculture Nursery Application to provide a comprehensive, user-friendly solution for plant care and nursery management, meeting the objectives of personalized plant care, gamified engagement, community interaction, and integrated e-commerce.

2.2 literature Review:

2.2.1 paper 1: UX case study: Plant care app - User-Centered Design in Plant Care Apps [15]

In recent years, the growing popularity of houseplants has created a demand for digital tools that assist users in managing plant care routines. Plant care apps offer reminders, monitoring tools, and guidance to help users maintain healthy plants.

The UX case study by Christina M.G. examines the process of designing a plant care app that supports users with diverse plant care needs. This study highlights design insights around usability, user engagement, and personalization in plant care apps. Reviewing this case study within the context of other literature on plant care apps and digital assistance in horticulture provides valuable insights into effective strategies for promoting user satisfaction and plant health.

Plant care apps are designed to address common challenges users face, such as inconsistent watering schedules, lack of knowledge about specific plant requirements, and uncertainty about diagnosing plant health issues. According to the case study, user research **identified key user** needs, including timely reminders, care guidelines tailored to specific plants, and community support. Studies show that guidance is particularly important for beginner plant owners, who benefit from structured, accessible advice on plant health indicators like soil moisture, light exposure, and nutrient needs . In alignment with these findings, the plant care app in Christina's study integrates personalized reminders and tips based on plant type and care frequency, addressing the varied needs of both novice and experienced users.



Figure 1: "Screenshot of the Miro board I created to identify themes from my interviews" -- from Christina M.G.research

One of the unique elements highlighted in Christina's case study is the integration of **community features**, allowing users to share insights and ask questions. The inclusion of community support fosters an interactive experience where users can benefit from shared knowledge, especially for troubleshooting and discovering care tips. Research on community-based digital platforms suggests that peer advice can enhance user engagement and satisfaction, as users feel supported by a network of others with similar interests . By enabling users to ask questions, share experiences, and exchange tips, plant care apps provide a space for ongoing learning, which has been shown to increase both user retention and plant care success rates .

To enhance user motivation, the case study emphasizes the potential of **gamification** features such as rewards, progress tracking, and achievements for consistent plant care routines. Gamification is widely used in digital applications to improve user engagement and can be particularly effective in habit-forming domains like plant care, where regular attention is needed. Studies indicate that gamified elements, such as badges, points, or streaks, promote adherence to routines

by creating a sense of accomplishment and motivating users to continue their care activities . Christina's approach to integrating gamification, where users can track their progress and earn rewards for maintaining healthy plants, aligns with research that supports gamification as a valuable strategy in fostering sustained user interaction.

The case study also underscores the importance of **intuitive design** in plant care apps, particularly for diverse user demographics. Simplified navigation, visually appealing interfaces, and clear instructions are crucial for usability, as they make plant care tasks easier to manage. Studies in **UX design** suggest that users are more likely to engage with digital tools that prioritize accessibility and simplicity, particularly for tasks that require frequent interaction, such as plant monitoring . By implementing a user-friendly interface with visual cues and easy access to care information, Christina's app addresses key usability concerns, aligning with best practices in UX design.

Christina M.G. also discusses how she created **wireframes** for her app as a crucial part of the design process. She emphasizes the importance of wireframes in visualizing the app's user interface and interaction flow early in the project. By sketching out basic layouts and features, Christina was able to plan the app's structure effectively, ensuring that all user interactions were intuitive and well-organized. The wireframes helped her identify and resolve potential design issues before diving into development, which allowed for a smoother workflow. She also highlights how wireframes serve as a communication tool with stakeholders and collaborators, helping everyone align on the design vision and functionality of the app. Ultimately, these wireframes were instrumental in creating a user-friendly and functional plant care app, ensuring a seamless user experience from the very beginning.

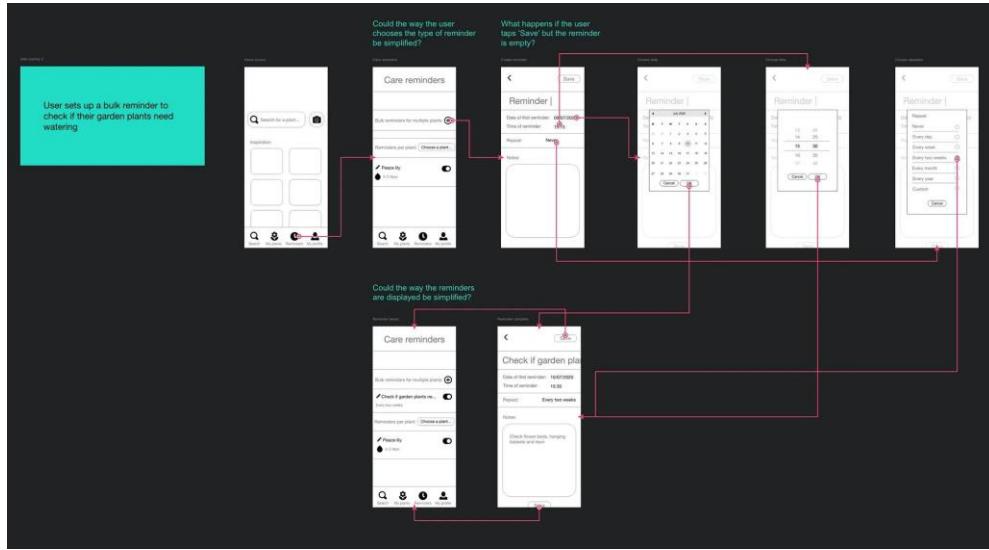


Figure 2: Overflow diagram - from Christina

Christina also mentions that whether the **wireframes** are created digitally or with **pen and paper**, both methods are equally important. The key is to create them, as they help visualize the app's structure and functionality early on.

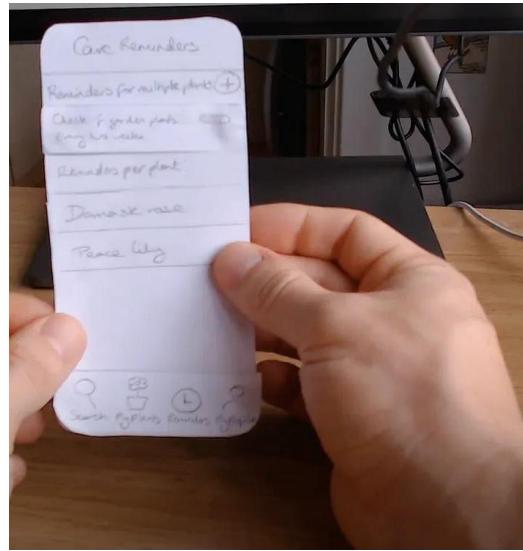


Figure 3: pen and paper wireframe from user testing video from Christina

Personalization in plant care apps can significantly impact **user satisfaction and plant health outcomes**. Christina's case study found that users responded positively to tailored recommendations based on plant species, environment, and individual

preferences. Research supports the notion that personalized care suggestions improve adherence to plant care routines, as users receive information that is specifically relevant to their plants . By providing users with specific watering schedules, sunlight requirements, and humidity preferences for different plant types, the app in the case study exemplifies how personalized advice can lead to better plant care outcomes and more engaged users.

The **UX case study** of Christina's plant care app provides valuable insights into effective design principles for plant care technology. By addressing user needs for guidance, fostering community support, and utilizing gamification, the app promotes sustained engagement and improves plant care outcomes. These findings are consistent with broader research on digital tools for plant care, underscoring the importance of personalized support, intuitive design, and community engagement in creating a successful plant care app. Future research could further explore the psychological benefits of plant care apps and the role of gamification in building sustainable plant care habits.

2.2.2 paper 2 : Exploring Flutter for Mobile App Development [16]

In the rapidly evolving landscape of mobile technology, Flutter, an open-source UI software development kit by Google, has garnered considerable attention for its **flexibility, performance**, and user-friendly approach. According to Raj Joshi (2024), Flutter empowers developers to create **natively compiled applications** for mobile, web, and desktop platforms using a **unified codebase**, thus significantly streamlining the development process. This framework stands out for its ability to deliver **high-quality, cross-platform applications** with a focus on speed, productivity, and code maintainability.

The research highlights that Flutter's innovative architecture is primarily driven by **widgets**, which form the foundational elements of the application's user interface. These widgets are categorized into several types, such as **state maintenance widgets**, which handle user interactions and data changes; **platform-specific widgets**, tailored to cater to the unique requirements of Android and iOS; and **layout widgets**, which organize the visual structure of the app. The modular and reusable nature of these widgets empowers developers to build rich, visually appealing interfaces that are both adaptable and performant across various devices. By leveraging the **Dart programming language**, Flutter provides a robust, object-oriented environment that supports modern programming paradigms, facilitating the development of scalable and maintainable applications.

One of the standout features of Flutter, as emphasized in the study, is its **hot reload** functionality. This feature significantly boosts developer productivity by instantly applying code changes without requiring a full restart of the application. This capability is particularly advantageous during the **prototyping and debugging** phases, as it allows for rapid iteration and real-time feedback, which accelerates the process of refining user interfaces and fixing issues.

Additionally, Joshi's research delves into the critical role of **state management**

within Flutter applications. Managing the state efficiently is vital for delivering smooth user experiences, especially in apps that involve real-time data updates and dynamic content. The framework offers various state management techniques, such as **Provider**, **Bloc**, and **Riverpod**, each of which caters to different complexity levels and use cases. Proper state management ensures that applications remain responsive and maintain a consistent user experience, even under heavy user interactions.

However, despite its numerous advantages, the research identifies some inherent **limitations** of Flutter. One of the key challenges pertains to **platform-specific variations**. While Flutter provides a comprehensive widget library that includes both **Material Design widgets** for Android and **Cupertino widgets** for iOS, developers may still encounter hurdles when striving for a truly native look and feel on each platform. This may necessitate additional customizations to align with the specific design guidelines of Android and iOS. Furthermore, integrating hardware-specific functionalities like camera access, GPS, and push notifications often requires using **platform channels**, which involve writing native code for each platform, adding a layer of complexity to the development process.

Joshi concludes that Flutter has the potential to revolutionize the way mobile applications are developed, offering a powerful solution for both **startups and established enterprises**. By leveraging a single codebase, Flutter not only minimizes development costs and reduces time-to-market but also enhances code maintainability and scalability. This makes Flutter a compelling choice for organizations aiming to develop cross-platform applications without compromising on quality or performance. The research ultimately positions Flutter as a transformative tool that bridges the gap between different mobile ecosystems, fostering innovation and efficiency in mobile app development.

2.2.3 Paper 3: Artificial intelligence in recommender systems. [17]

Recommender systems have become **essential** for helping us navigate the overwhelming choices available online, whether we're picking a new movie to watch, finding a product to buy, or discovering a playlist that suits our mood. By analyzing our **past behavior**, these systems try to predict what we'll like next. Thanks to advancements in **artificial intelligence (AI)**, especially in fields like **machine learning** and **computational intelligence**, these systems are now better than ever at personalizing recommendations and tackling challenges like **data sparsity** and **cold-start issues**, where the system lacks enough information to make accurate suggestions. **Zhang, Lu, and Jin (2020)** explore these **AI-driven innovations** in recommender systems, reviewing the **methods**, **technologies**, and **real-world applications** that have shaped this field.

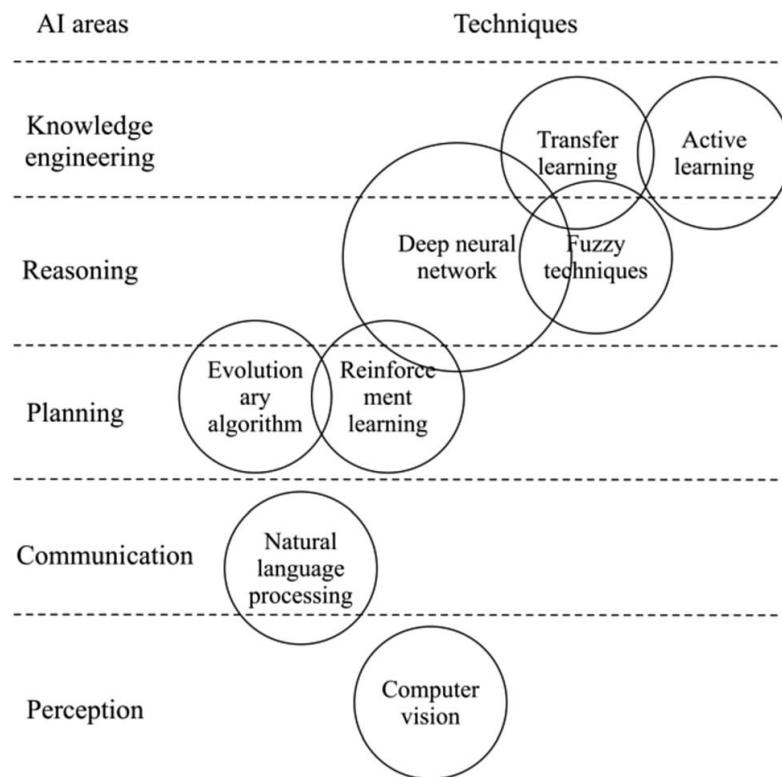


Figure 4: AI areas and techniques

AI has breathed new life into recommender systems, allowing them to process **massive amounts of data** and make sense of complex **user preferences**. Techniques like **fuzzy logic**, **neural networks**, and **deep learning** help recommender systems understand and interpret our choices in nuanced ways. In **Figure 4**, we see how these AI techniques are woven into different areas of recommendation, from reasoning and planning to communication and perception. For instance, **deep neural networks** are used to recognize patterns in **user behavior**, while transfer learning allows the system to apply insights from one context (like **movie preferences**) to another (like **book recommendations**). This mix of techniques enables systems to handle vast datasets and offer genuinely **personalized suggestions**.

Recommender systems generally rely on three main approaches to suggest items: **content-based**, **collaborative filtering**, and **knowledge-based methods**. Content-based systems recommend items that are similar to what a user has already shown interest in. On the other hand, collaborative filtering looks at how similar users' preferences are, suggesting items based on what others with similar tastes have liked. Knowledge-based systems, however, use **domain-specific knowledge** to make recommendations, making them especially useful in areas like **healthcare** and **finance**. With the help of AI, these methods are getting even better, as techniques like **deep neural networks** can now uncover complex patterns to enhance the accuracy of predictions.

One area that has gained significant attention recently is **reinforcement learning (RL)**, a technique that helps recommender systems strike a balance between **exploration** (trying new recommendations) and **exploitation** (sticking with what the user already likes). Initially, RL methods treated this as a kind of "**bandit problem**," where the system tests different recommendations to see what sticks. Over time, these methods have evolved, using **deep reinforcement learning (DRL)** approaches that address both **immediate** and **long-term satisfaction**. **Zhang, Lu,**

and Jin explain how platforms like **YouTube** and **Alibaba** are already using DRL to enhance their recommendation strategies, showing just how valuable this approach is in the real world.

Fuzzy techniques also bring unique value to recommender systems by handling the **gray areas** of user preferences. Real-world data is often messy, vague, or incomplete, and **fuzzy logic** is great at managing this kind of uncertainty. For instance, in content-based systems, fuzzy techniques can help make sense of **ambiguous item descriptions** and **subjective feedback**. In collaborative **filtering (CF) systems**, fuzzy logic improves accuracy by accounting for noise and partial data, such as incomplete ratings. Fuzzy clustering methods, for example, allow users and items to belong to multiple groups, which better reflects the complexity of human preferences. These fuzzy methods are particularly helpful in domains where user data is complex or changes rapidly, like e-commerce and healthcare.

Evolutionary algorithms (EAs) are a powerful AI tool that enhance recommender systems' performance by optimizing for multiple objectives like **accuracy**, **novelty**, and **diversity** simultaneously. **Zhang, Lu, and Jin** (2020) explain how EAs balance between providing familiar recommendations and introducing users to new options. Additionally, they create **flexible user and item profiles** that adapt to shifts in user preferences. In privacy-sensitive contexts, EAs can also contribute to securing recommender systems through **federated learning**, which processes user data locally rather than on a central server, ensuring **security** and **adaptability**.

Natural Language Processing (NLP) and **computer vision** bring a whole new dimension to recommender systems. These technologies make it possible to analyze rich sources of information, like **reviews**, **descriptions**, and **images**, which provide deeper insights into user preferences. For instance, in domains like movies or books, NLP can extract valuable details from user reviews, helping the system understand not just what people like, but why. Imagine a **book recommendation system** that reads between the lines of user reviews, identifying the **themes**, **writing styles**, or

characters that resonate most. By integrating sentiment analysis and topic modeling, NLP enables more meaningful, personalized suggestions that go beyond simple ratings.

In summary, AI has transformed recommender systems from simple algorithms into sophisticated tools capable of providing personalized, nuanced, and adaptable recommendations. **Zhang, Lu, and Jin** (2020) conclude that with innovations like **deep reinforcement learning, evolutionary algorithms, and advanced NLP**, recommender systems are set to become even more integral to our digital experiences, helping us discover what we need and maybe even what we didn't know we wanted.

2.3 similar related apps :

2.3.1 Plants companion: [18]

The PlantsCompanion app is made specifically for indoor plants, by keeping track of important tasks like watering, fertilizing, and repotting. Users can make a list of their plants and set reminders for each one, helping them remember when it's time for certain care tasks. Each plant entry also allows users to add details, like the type of plant, and any personal notes, which is helpful for both beginners and experienced plant lovers.

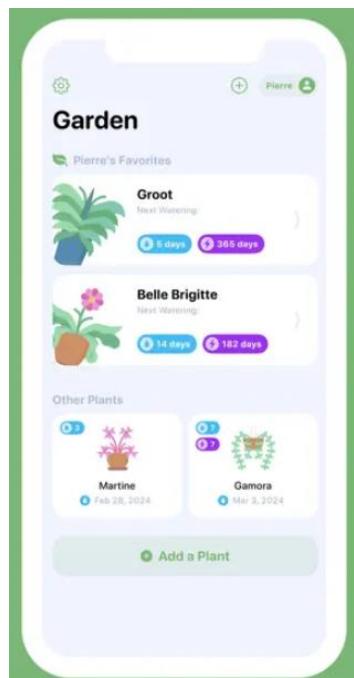


Figure 5:plant companion homepage

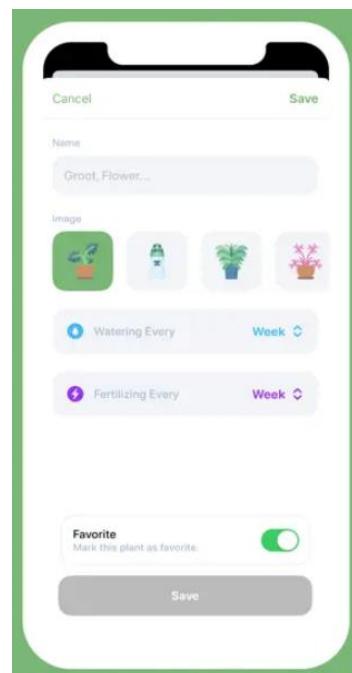


Figure 6: plant companion add plant

2.3.2 Plant watering reminder: [19]

The "Plant Watering Reminder" app helps users manage their plant care by setting reminders for tasks like watering, fertilizing, and other routine maintenance. It supports various plant types, providing tailored care tips for each, which is especially helpful for plant owners with diverse collections. Users can customize their care schedules and track their plants' growth over time, ensuring that each plant receives the attention it needs. The app sends timely notifications to remind users of important tasks.

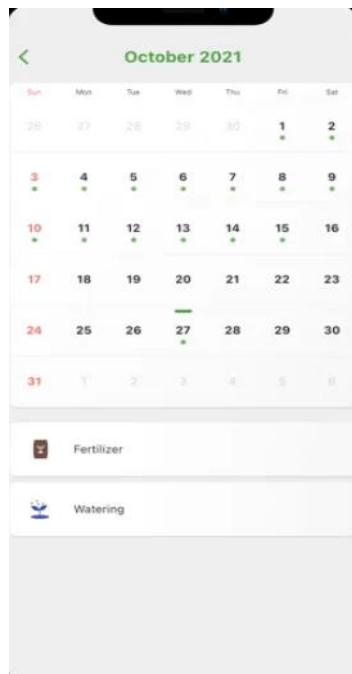


Figure 8: Plant Watering Reminder app – calendar



Figure 7:Plant Watering Reminder app – showing tasks on the calendar

2.3.3 Plant hunter - growth tracker: [20]

The PlantHunter - Growth Tracker app is for plant enthusiasts looking to track and understand the growth and development of their plants over time. This app allows users to log key milestones such as planting, pruning, and repotting, providing a comprehensive record of each plant's journey. By documenting these significant events, users can monitor their plants' progress and identify growth patterns that are crucial for optimal care. The app not only helps users stay organized but also deepens their understanding of plant needs, making it easier to provide the right care and ensure their plants thrive over time. With its user-friendly interface, PlantHunter makes plant care more engaging and insightful, making it an essential companion for both novice and experienced gardeners alike.

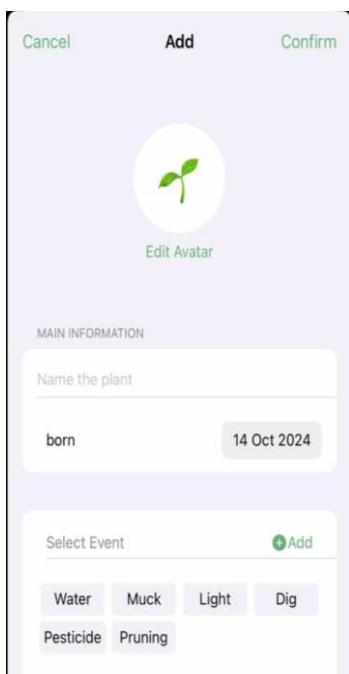


Figure 12: plant hunter app – add plant

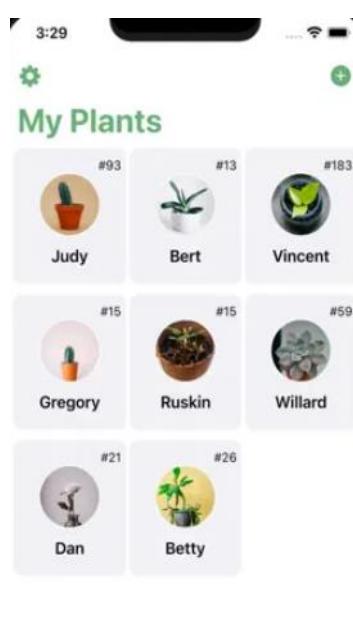


Figure 11: plant hunter app – view all plants

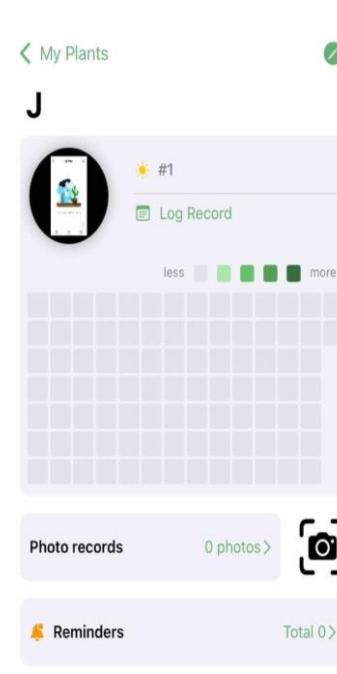


Figure 10 : plant hunter see plant log



Figure 9: plant hunter app – greenAide chat bot

2.3.4 Planton: [21]

Planton Easy Plant Care is an educational app designed to help plant lovers of all experience levels improve their plant care skills. It offers a variety of interactive lessons, quizzes, and games that break down complex botanical topics into easy-to-understand courses. It is made for both beginners or advanced gardeners, the app provides valuable knowledge to help users care for their plants more effectively. In addition to the educational content, Planton includes tools for plant identification and features competitive quizzes that allow users to test their plant care expertise. This app is a great way to learn, grow, and challenge yourself as a plant enthusiast while ensuring your plants thrive.

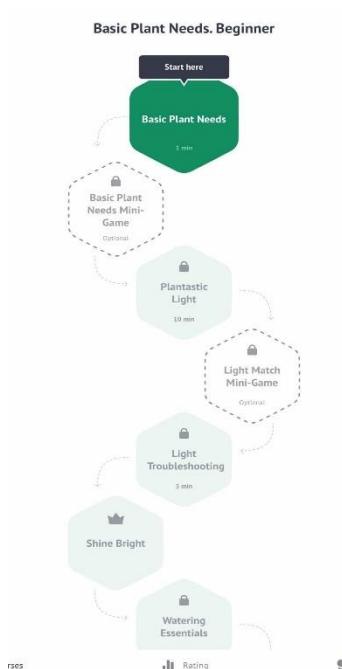


Figure 13: planton app – achievement road map



Figure 14: planton app – basic plant needs quiz



Figure 15: planton app – learning game activity

2.3.5 Gardenize: [22]

Gardenize is a versatile **gardening journal and planner app** designed to support gardeners in managing their green spaces efficiently. Users can track plant growth, manage planting areas, and organize tasks like watering, fertilizing, and pruning, ensuring they never miss an essential gardening step. Gardenize allows users to customize their experience by selecting preferences and interests, which personalize the app's features to suit individual gardening goals. Additionally, the app fosters a sense of community with a dedicated hub where gardeners can connect by following each other, searching for profiles, sharing posts, saving posts for later, and engaging in real-time chats. The Gardening Journal and Planner feature enables users to create private or public gardens, add detailed descriptions for each plant, and stay organized by setting up to-dos and scheduling future tasks. Gardenize not only provides a structured approach to gardening but also builds a community where knowledge and inspiration flourish.

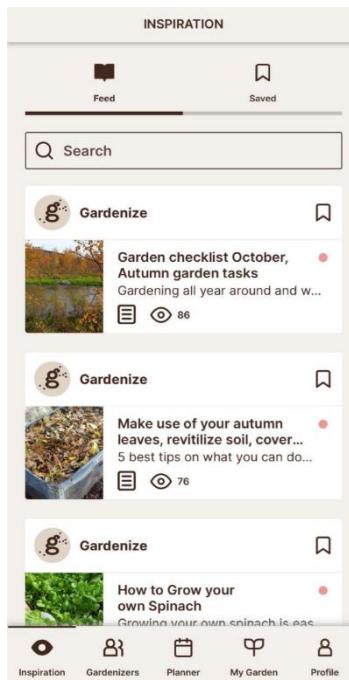


Figure 16: Gardenize App - Posting In The Inspiration Feed

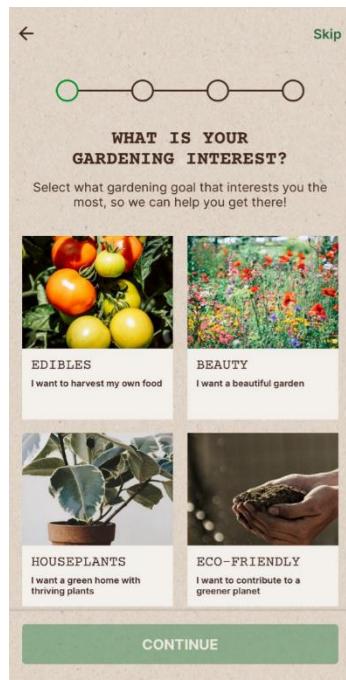


Figure 17: Gardenize App - Selecting Preferences & interests



Figure 18: Gardenize App - Adding Plants to The Garden

2.3.6 Planto [23]

Planto is a user-friendly app created to help plant enthusiasts discover new plants and cultivate their personal gardens. With its personalized plant addition feature, users can upload photos of their own plants, add details like care instructions, and personalize each entry, making their digital garden a true reflection of their unique collection. The app also offers a powerful search feature, allowing users to explore a vast plant database that provides information on different species, ideal growing conditions, and more. This makes it easy for users to find plants they're interested in and seamlessly add them to their gardens. Planto's combination of personalization and accessibility makes it an essential tool for anyone looking to deepen their gardening knowledge and grow their green thumb.

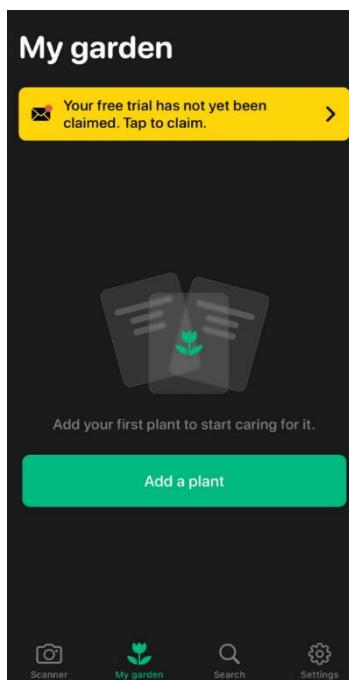


Figure 19: Planto App- Add Plants to The Garden

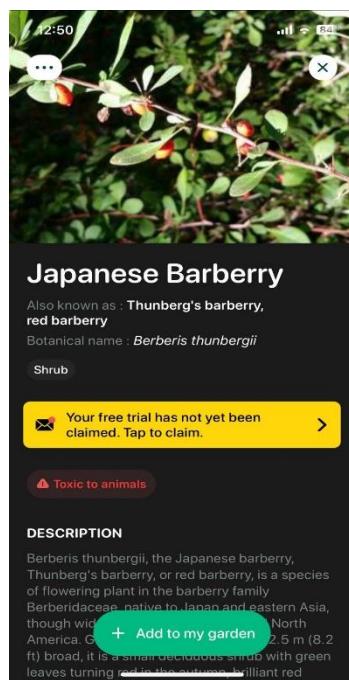


Figure 20: Planto App - Search For Plants

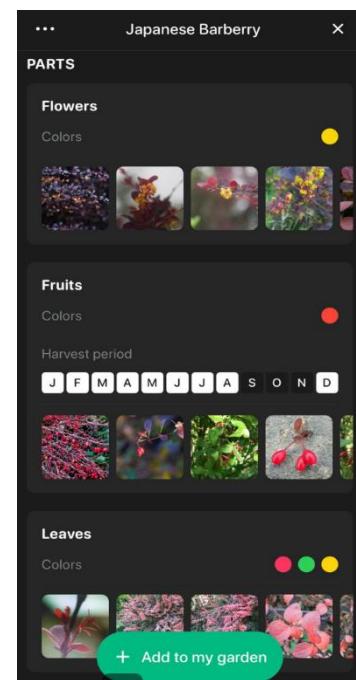


Figure 21: Planto App- Show Plant's Info

2.3.7 PlantNet [24]

PlantNet is an intuitive app designed to help plant enthusiasts and botanists explore and identify plants with ease. It features a well-organized plant database where users can browse plants categorized by family, genus, and species, making it straightforward to find detailed information on a wide variety of plants. This organization is ideal for anyone seeking to deepen their botanical knowledge or identify specific plants based on scientific classifications. Additionally, PlantNet encourages a sense of community with its group creation feature, allowing users to form or join groups with others who share similar plant interests. Whether for sharing insights, exchanging care tips, or discussing unique plant varieties, PlantNet's group feature makes it easy for users to connect, collaborate, and foster a shared passion for plants.



Figure 22: PlantNet App - Organize plants into categories

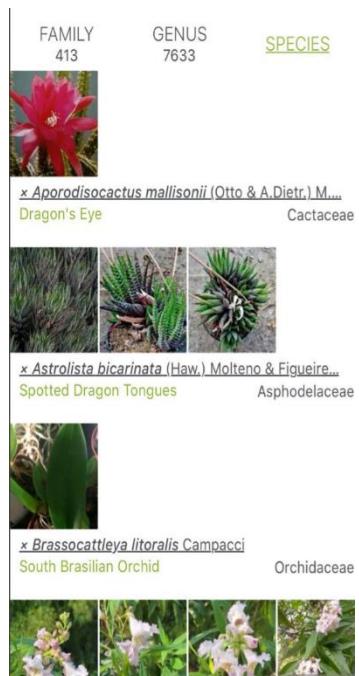
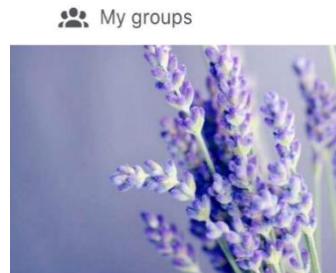


Figure 23: PlantNet App - Show Category info



Groups allow to pool observations of several members around taxa of common interest or a geographical area.

The aims are to have a quick access to data of interest, to create a map of observations and to export this data.

[View all groups](#)

2.3.8 Flora incognita [25]

Flora Incognita is an innovative app that combines plant identification with interactive exploration, enhancing users' learning through gamification. Using location-based technology, the app provides a tailored list of plant species relevant to the user's current area, making it easy to discover and learn about local flora. Flora Incognita also offers engaging challenges that motivate users to explore its features more deeply. As users complete these challenges, they earn badges and unlock unique information about various plants, adding a fun and rewarding element to the learning process. This gamified experience transforms plant identification into an exciting activity, encouraging users to explore their surroundings while expanding their botanical knowledge.

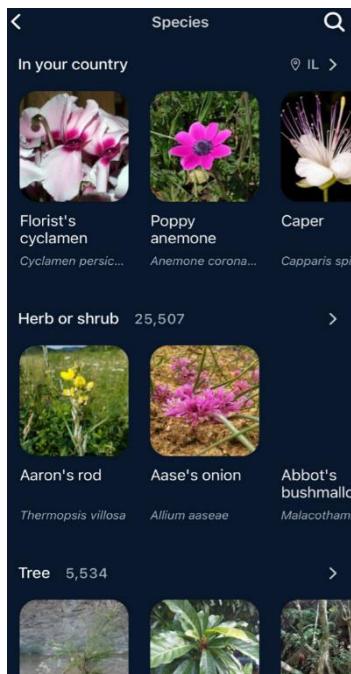


Figure 25: Flora incognita – Organize Plants Into Categories



Figure 26: Flora incognita – Articles For More Info

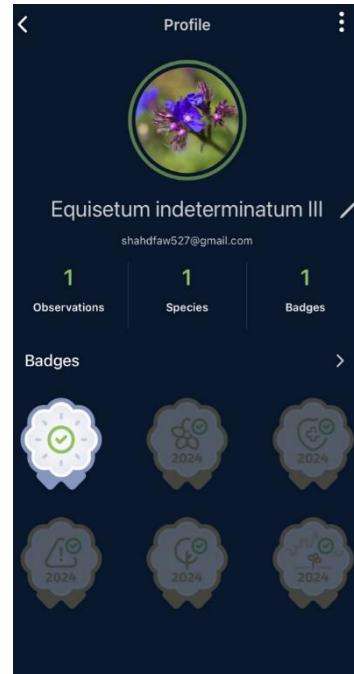


Figure 27: Flora incognita – User's Badges

2.3.9 Planta [26]

Planta is a comprehensive plant care management app designed to assist users in keeping their plants healthy and thriving. By providing personalized care schedules, it notifies users when to water, fertilize, or re-pot their plants based on species-specific needs, ensuring optimal care. The app's light recommendation feature assesses the environment and advises on the best locations for plants within a home or garden. Planta also integrates AI-powered plant identification,

which helps users quickly identify unknown plants by simply snapping a photo. Additionally, it offers a plant health diagnosis tool that helps detect early signs of plant issues like overwatering, pests, or nutrient deficiencies, enabling users to take preventive action. Overall, Planta combines advanced technology with practical plant care guidance, making it a valuable resource for both beginners and seasoned plant enthusiasts.

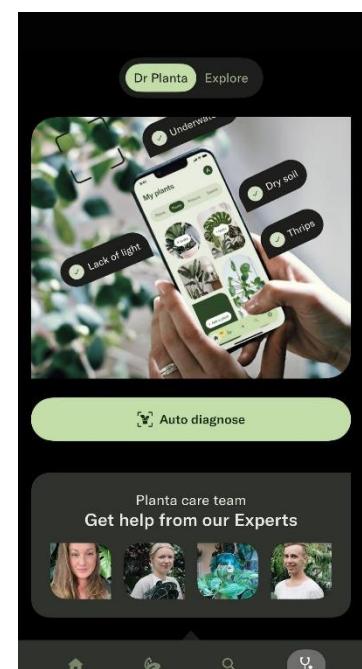
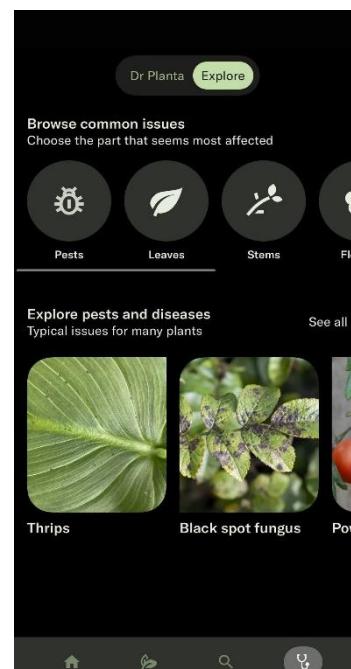
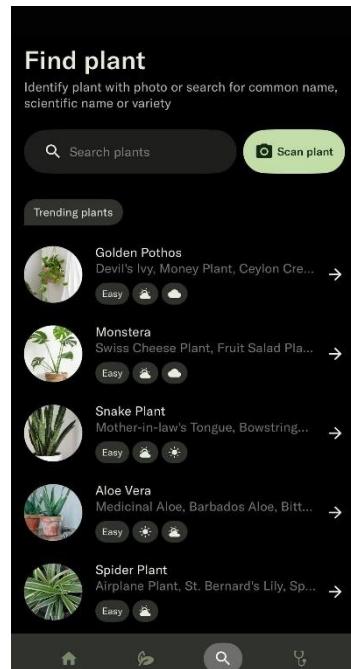
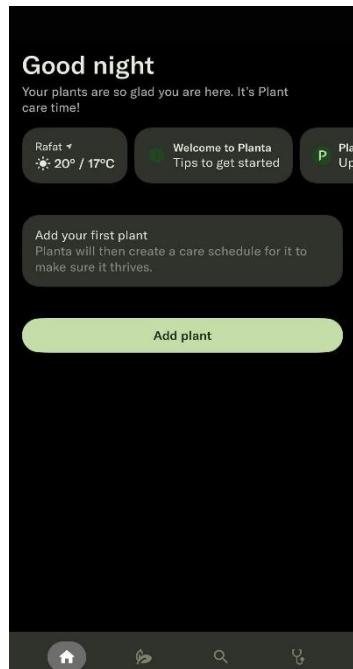


Figure 30: Planta app-Add plants and view plants

Figure 29:Planta app-search Plants

Figure 31:Planta app-Explore diseases

Figure 28:Planta app-Auto diagnose for plants

2.3.10 GardenTags [27]

GardenTags is a social gardening app that blends plant care tracking with a vibrant community experience. Ideal for gardening enthusiasts, GardenTags allows users to catalog their plants, receive care reminders, and access a vast library of plant information that includes species-specific care tips. Beyond its care-tracking features, the app fosters community engagement by allowing users to share photos of their plants, exchange gardening tips, and discuss various plant-related topics with other gardeners worldwide. GardenTags includes a comprehensive plant guide, enabling users to explore detailed information about numerous plant species and make informed choices for their gardens. It also has an identification feature for users to recognize unknown plants and trees in their environment. The social aspect of GardenTags provides a collaborative experience, making gardening more enjoyable and less isolated.



Figure 35: GardenTags-Discover and explore global posts



Figure 34: GardenTags-explore following people posts

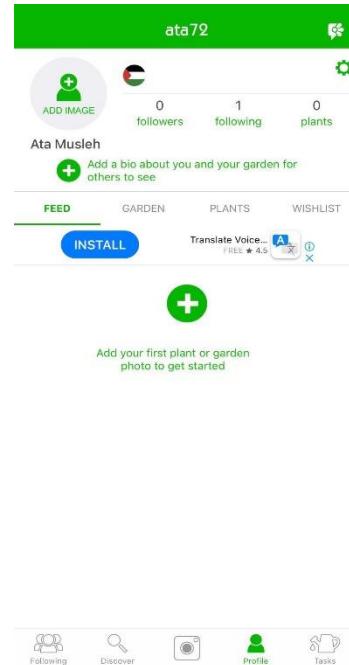


Figure 33: GardenTags-View Profile

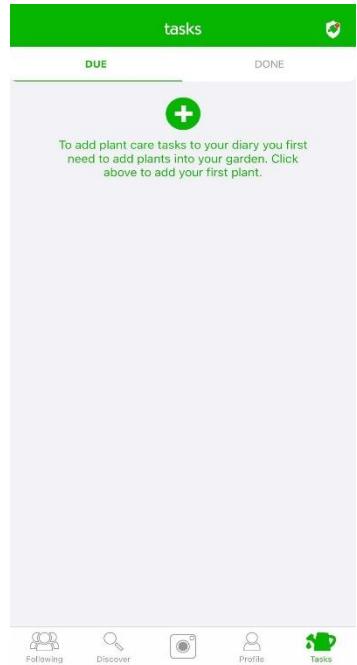


Figure 32: GardenTags-View Tasks

2.3.11 Leafsnap [28]

LeafSnap is a visually driven, AI-powered app specializing in plant identification and diagnostics. Users can identify plants simply by taking a photo of the leaves, flowers, bark, or fruit, and the app instantly provides identification with accuracy based on its extensive plant database. Beyond identification, LeafSnap includes in-depth care guides tailored to each species, equipping users with information on ideal light, water, and soil conditions for plant health. Another unique feature is its early detection of plant diseases, allowing users to identify potential health issues before they escalate. LeafSnap's recommendations are informed by scientific research and offer proactive care measures to keep plants in peak condition. This combination of advanced AI, a comprehensive plant database, and detailed care instructions makes LeafSnap a useful tool for any plant lover or home gardener.

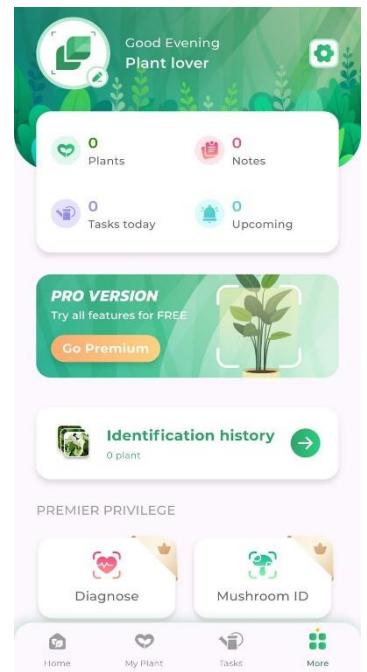
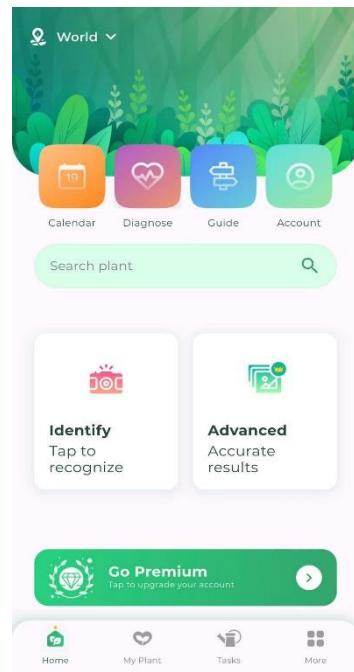
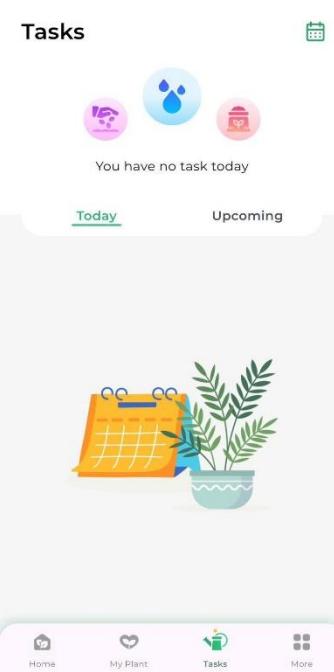


Figure 38:Leafsnap-View Tasks

Figure 37:Leafsnap-Home Page

Figure 39:Leafsnap-My Plants page

Figure 36:Leafsnap-Statistics and diagnoses

2.3.12 Growing Guide [29]

Growing Guide is a gardening app that emphasizes practical, step-by-step instructions for cultivating a wide variety of plants, from flowers and vegetables to culinary herbs. It includes detailed care instructions for every stage of plant growth—from planting seeds to harvesting. Growing Guide also provides seasonal planting calendars, which help users time their planting efforts for maximum yield, as well as care schedules tailored to the local climate and growing conditions. The app offers advice on soil preparation, planting depth, watering needs, and fertilization techniques, making it a reliable resource for managing garden plants throughout the year. Growing Guide's accessible format and seasonal reminders are designed to simplify gardening tasks, helping users grow healthy plants with confidence, regardless of their level of experience.



Sow
Planting seed by scattering or placing in soil

Perennial
Lasting or existing for a long time: enduring or continually recurring

Annual
Occurring once every year

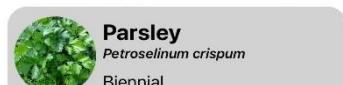
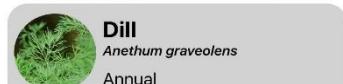
Biennial
Living or lasting for 2 years or a plant that takes 2 years to grow from seed to fruition and die

Pollinate
Carry pollen from one plant to another to allow fertilization and creation of seeds

Germination / Germinate
The time it takes for a seedling to break out of the seed's shell and grow its first roots



Search...
Tap to view more information such as sowing, growing, and harvesting



Classification: Perennial
Germination time: 10 – 14 days
Sun exposure: Full sun
Sun exposure time: 8 or more hours
Planting depth: 1/4 in
Plant spacing: 12 in
Average height: 1 – 2 ft
Maturity time: ~90 days
Growing temp: ~45 – 55°F

Uses for this herb

- Used for cooking. Can be an ingredient in jams and jellies, desserts, baked goods, candy, breath mints, extracts, and beverages like tea and smoothies

- Commonly used for cosmetics like toothpaste, soaps, air fresheners, face masks, and mouthwashes



Planting and Growing

Peppermint is a really tricky plant to grow. Peppermint seeds are one of the smallest herb seeds and are nearly impossible to see when placed in soil. Before digging holes, let us tell you that peppermint is very intolerant to being planted too deep into the soil. For best results, place the seeds on the top of the soil and gently press them. Peppermint will germinate best when they are exposed to at least a little bit of sunlight.

IMPORTANT: Do not grow peppermint in an open area! Peppermint is classified as a weed, not just an herb. Peppermint expands out by growing runners. These are roots that are capable of growing a new plant. Consider putting them in an enclosed bed or pot to prevent the spread of peppermint runners. If peppermint is not watched in the open, it can just as well take over your entire garden!

After peppermint germinates, the plant basically takes care of itself, considering that it is a natural weed. The only thing that really needs to be done is

Figure 43: Growing Guide-Plant terminology

Figure 42: Growing Guide-List of Herbs

Figure 41: Growing Guide-Herbs details page

Figure 40: Growing Guide-Herbs information

2.4 comparison table:

Table 1: app comparison table

| Feature/ App Name | Gardenize | Planto | PlantNet | Flora Incognita | Planta | Garden Tags | LeafSnap | Growing Guide | planton | Plant hunter | Our App |
|--|-----------|--------|----------|-----------------|--------|-------------|----------|---------------|---------|--------------|---------|
| create/manage garden and add plants | ✓ | ✓ | ✗ | ✗ | ✓ | ✓ | ✓ | ✓ | ✗ | ✓ | ✓ |
| Set Reminders (Watering, Fertilizing, Repotting) | ✓ | ✓ | ✗ | ✗ | ✓ | ✓ | ✗ | ✓ | ✗ | ✓ | ✓ |
| set weather based reminders | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✓ |
| logging and tracking care activities | ✓ | ✓ | ✗ | ✗ | ✓ | ✗ | ✗ | ✓ | ✗ | ✗ | ✓ |
| Provide care tips | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ | ✓ | ✓ |
| Community platform for sharing | ✓ | ✗ | ✓ | ✓ | ✓ | ✓ | ✗ | ✗ | ✗ | ✗ | ✓ |
| Early detection of plant diseases | ✗ | ✗ | ✗ | ✗ | ✓ | ✗ | ✓ | ✗ | ✗ | ✗ | ✗ |

| | | | | | | | | | | | |
|-----------------------------------|---|---|---|---|---|---|---|---|---|---|---|
| Search Plants (Large Database) | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ | ✗ | ✓ | ✓ |
| Engaging challenges and badges | ✗ | ✗ | ✗ | ✓ | ✗ | ✗ | ✗ | ✗ | ✓ | ✗ | ✓ |
| Organized Plant List | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ | ✓ | ✓ |
| Profile & Community Features | ✓ | ✗ | ✓ | ✗ | ✓ | ✓ | ✗ | ✗ | ✓ | ✗ | ✓ |
| create accounts | ✗ | ✓ | ✗ | ✗ | ✗ | ✗ | ✗ | ✓ | ✗ | ✓ | ✓ |
| provide feedbacks | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✓ |
| searching and browsing products | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✓ |
| provide article | ✗ | ✗ | ✗ | ✓ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✓ |
| chatting with other users | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✓ |
| chat bot | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✓ | ✓ |
| notifications | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| manage store | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✓ |
| email notifications | ✓ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ | ✓ |

Chapter 3: Approach

This chapter shows our set working plan, methodology, and the resources that will be used. It will also address the ethical considerations of this project.

3.1 Methodology

- We have adopted an Agile methodology, specifically utilizing the Scrum model. This approach is well-suited for our objectives as it emphasizes flexibility, collaboration, and iterative progress, which are crucial for addressing the complexities involved in modernizing traditional plant nurseries.

3.1.1. Why Agile? [30]

- We chose Agile due to its ability to accommodate changes and enhancements throughout the development process. Given that our project aims to enhance user engagement and improve operational efficiency for nurseries, it is essential to remain adaptable to user feedback and evolving requirements. Agile allows us to iteratively develop features, enabling us to incorporate user insights quickly and make adjustments as necessary.

3.1.2. Project Initiation:

- Our project started with a close look at existing plant-related apps, especially those focused on nurseries and plant care. We found that users often had trouble taking care of their plants because they didn't have enough information, and nurseries struggled to manage their inventory and connect with customers effectively. By understanding these problems, we realized there was a need for a solution that could help both users and nurseries.
- This led us to create the **Smart Agriculture Nursery Application**. Our goal is to make plant care easier for users and improve how nurseries operate. We wanted to design an app that teaches users about plant care and helps nurseries manage their services better.
- To start the project, we held brainstorming sessions to share and develop our ideas based on what we learned from other apps. These sessions helped us decide on important features that would benefit our users, like personalized reminders for plant care, a fun gaming

element, and a shopping platform for supplies. We organized our work into smaller parts, called sprints, focusing on different features of the app one at a time.

3.1.3. Development Process and Planning:

- Our development process includes weekly team meetings (3-4 times) to review progress, address any obstacles, and plan the next steps. We also hold a weekly meeting with our supervisor to gain insights and feedback on our development efforts. This structure ensures that we remain aligned with our project goals and can effectively communicate our progress.
- As we move forward, we plan to arrange a meeting with a nursery owner to gain firsthand insights into their needs and challenges. This interaction will allow us to gather critical requirements that will guide our development efforts, ensuring that our application is tailored to real-world use cases.

3.1.4 Conclusion and Project Summary

- In summary, our Agile approach, coupled with the Scrum model, enables us to develop the Smart Agriculture Nursery Application efficiently while remaining responsive to user needs. We will start with the analysis and design phases, followed by iterative development and testing, ultimately leading to the deployment of a fully functional application. This methodology not only fosters collaboration and innovation but also ensures that our final product effectively addresses the challenges faced by plant nurseries and enhances the user experience.

3.2 Resources

1. Hardware Resources

- Developer Laptops/Desktops: High-performance computers with at least 8GB RAM (16GB preferred) to support Android Studio and smooth app testing.
- Android Testing Devices: A variety of Android phones and tablets to test across screen sizes, resolutions, and API levels.
- Internet Connection: Reliable internet for accessing collaborative tools, cloud resources, and remote testing services.

2. Software and Development Tools

- Android Studio: Primary IDE for Android development, includes emulators to simulate device conditions.
- Java Development Kit (JDK): Necessary for coding in Java/Kotlin for Android.
- Firebase: Backend services like authentication, real-time database, and push notifications.
- Postman: API testing tool to ensure reliable backend communication.
- Git and GitHub: Version control for collaborative development.
- Figma: UI/UX design and prototyping tool, essential for consistent app visuals.
- Notion: Project management and task tracking to maintain team organization.

3. Documentation and Learning Resources

- Android Developer Documentation: Comprehensive guide for Android APIs, libraries, and best practices.
- Firebase Documentation: References for integrating Firebase services.
- Stack Overflow: Community resource for troubleshooting.
- YouTube & Online Courses:
Tutorials on advanced features and development methodologies.

4. Testing and Debugging Resources

- Emulator in Android Studio: Basic testing across different device configurations.
- Physical Devices: Real-world testing to detect performance and UI issues.
- Firebase Test Lab: Testing across a variety of devices and configurations.

5. Backend Services and APIs

- Spring Boot Framework: For custom server-side logic, handling user accounts and plant data.
- Weather API: Dynamic, location-based plant care advice based on real-time weather.

3.3 Work Plan

Our development process is structured to promote collaboration and ensure consistent progress toward our project goals. During the current semester, we will focus on software analysis, identifying the requirements, and determining the tools and technologies we will use in the next semester. This foundational work is critical for setting a strong base for our development efforts.

We will hold weekly team meetings 3-4 times a week to review our progress, discuss any challenges we may be facing, and plan the next steps in our development. These meetings will provide an opportunity for each team member to share their updates and any obstacles encountered, fostering a collaborative environment where we can brainstorm solutions together.

In addition to our team meetings, we will have a weekly meeting with our supervisor. This meeting will be essential for gaining valuable insights and feedback on our development efforts. The input from our supervisor will help us stay aligned with our project objectives and ensure that we are on the right track.

As we progress, we plan to arrange a meeting with a nursery owner. This interaction is crucial

for us to understand the real-world needs and challenges faced by nurseries. By gathering first hand insights, we will be able to identify key requirements that will shape the development of our application, ensuring it is relevant and effective for users.

To facilitate a smooth workflow, we will break down our project into smaller sub-tasks that can be worked on in parallel by different team members. Each meeting will serve as a platform to discuss the status of these tasks, allowing us to coordinate our efforts and make adjustments as necessary. This roadmap will not only guide our development process but also ensure that we remain adaptable and responsive to any changes or new insights that arise throughout the project. In the next semester, once we have completed the analysis and selected the necessary technologies, we will begin the development of the application, implementing the features and functionality that align with our goals.

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