Software Requirement Specification - PlantPal

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1. Introduction

1.1 Background & Motivation

Indoor plants are increasingly used to improve living spaces and well-being, yet beginners struggle with three pivotal moments: *before buying* (no assessment of light/time/pets/allergy constraints and plant–home fit), *first week after purchase* (no actionable onboarding steps), and *ongoing care* (diagnosing yellowing, drooping, or stalled growth is cognitively heavy, and guidance quality varies). We propose a mobile product, PlantPal, combining AI recognition, a structured care knowledge base, and a lightweight rules/learning engine to cover the full loop from "*Is this plant right for me?*" to "*How do I maintain it?*". Interaction leans on the principle of "the lowest-risk first step" so users can act quickly under uncertainty.

1.2 Project Goals

With measurable product outcomes:

a. deliver stable recognition for common indoor species with top-k + confidence and manual confirmation;

b. build a **plant dossier** to hold species, photos, events, and a timeline;

c. provide a **Week-1 Quick-Start** checklist and editable reminders to improve early retention;

d. output **fit assessments** with alternatives when a plant is unsuitable;

e. in troubleshooting, always provide **one** lowest-risk, at-home action plus a follow-up reminder. Core KPIs: activation, week-1 retention, reminder completion rate, and user-reported survival/confidence. These metrics drive iterative learning.

1.3 User Segments

Based on the needs breakdown, we target three segments:

- **Before Purchase**
  - **With intent to care**: Primary question is "*Does this plant fit me?*". They care about aesthetics, ease of care, pet safety, allergy risk, and if it does not fit—clear **alternatives** with reasons.
  - **No intent to care**: Do not plan to buy now; want quick recognition and a concise **species card** for rare/unknown plants.
- **Bought but Not Started**
  Need a clear **Week-1 How-To** list: placement, whether to repot, whether to water immediately, **minimal toolkit** (medium/pot/watering tool), and **don't-do** items (e.g., "No frequent watering in the first 48h; avoid direct harsh sun"). Local factors (weather/region/placement) are incorporated into the checklist logic rather than separate modules.
- **Already Caring**
  Focus on forgetfulness (watering/fertilizing/repotting reminders), **auto-adjusting plans**, difficulty judging health (symptom check/illness or not), and **stage tracking** with a timeline.

1.4 Key Usability Targets

Design is constrained by:

1. time to show candidates ≤ 2 s (local cache) / ≤ 5 s (with network);
2. first dossier creation ≤ 60 s (confirm/name/start reminders);
3. 80% of Week-1 tasks in ≤ 3 steps;
4. critical paths reachable in ≤ 3 taps (identify→confirm→create, view checklist, log a watering);
5. plain language for non-experts (short sentences, verb-first, minimal jargon), with bilingual CN/EN and accessibility (contrast, touch targets). Together with performance, privacy, and reliability NFRs, these form MVP acceptance criteria.

2. Strategic Analysis

2.1 SWOT

Category	Items
Strengths	• Clear user pain points • Focused MVP scope • Delightful AI recognition • Structured plant dossier drives retention • Privacy-first design builds trust
Weaknesses	• Limited species coverage at cold start • Accuracy depends on photo quality • Ongoing content curation workload • Device/hardware variability
Opportunities	• Partnerships with plant shops • Freemium premium care plans • IoT sensor integrations • Localized species/care packs • Community & UGC features
Threats	• Competing plant-care apps • Model drift/misidentification risk • Seasonality of demand • Data/AI regulatory changes

2.2 TOWS

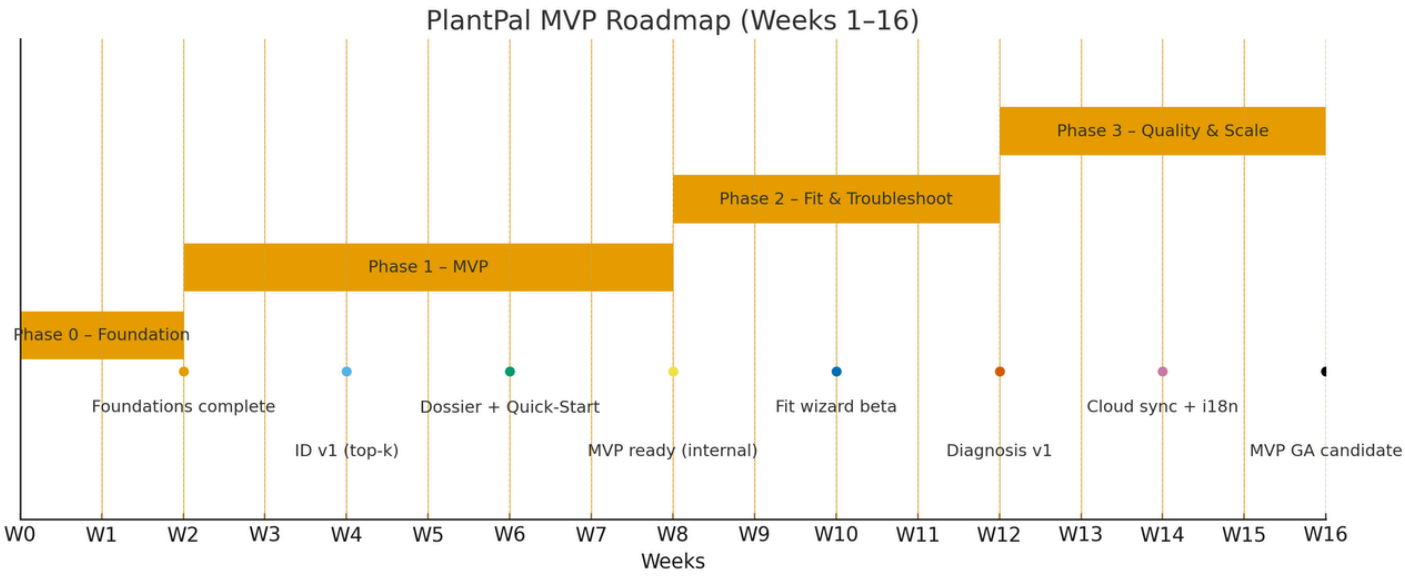
	Opportunities (O)	Threats (T)
Strengths (S)	SO strategies: 1) Pair AI recognition with in-store scan-to-fit + referral flows. 2) Use privacy-first positioning to co-market with shops and campuses.	ST strategies: 1) Differentiate vs competitors through privacy-first + transparent confidence & manual confirm. 2) Establish monitoring/retraining to counter model drift; message quality/trust.
Weaknesses (W)	WO strategies: 1) Mitigate limited coverage by localizing top-N species per region; crowd-label with review. 2) Reduce curation load via templated care profiles and incremental content tooling.	WT strategies: 1) Smooth seasonality with evergreen campaigns (Week-1 kits, pet-safe packs). 2) Minimize regulatory exposure by local-first storage and explicit cloud opt-in.

2.3 Goals & Initiatives

- **G1 (MVP adoption)**: 1,000 WAU within 3 months → *initiatives*: in-store QR onboarding; campus/office beta; invite rewards.
- **G2 (Care outcomes)**: 30% reduction in plant loss at month 3 → *initiatives*: Week-1 flows; one safest first step; action-logging nudges.
- **G3 (Quality & trust)**: >90% perceived accuracy at species-group level → *initiatives*: progressive disclosure; manual confirm; human-in-the-loop corrections.

3. Roadmap (MVP)

3.1 MVP timeline (Weeks 1–16)



3.2 Phase bars

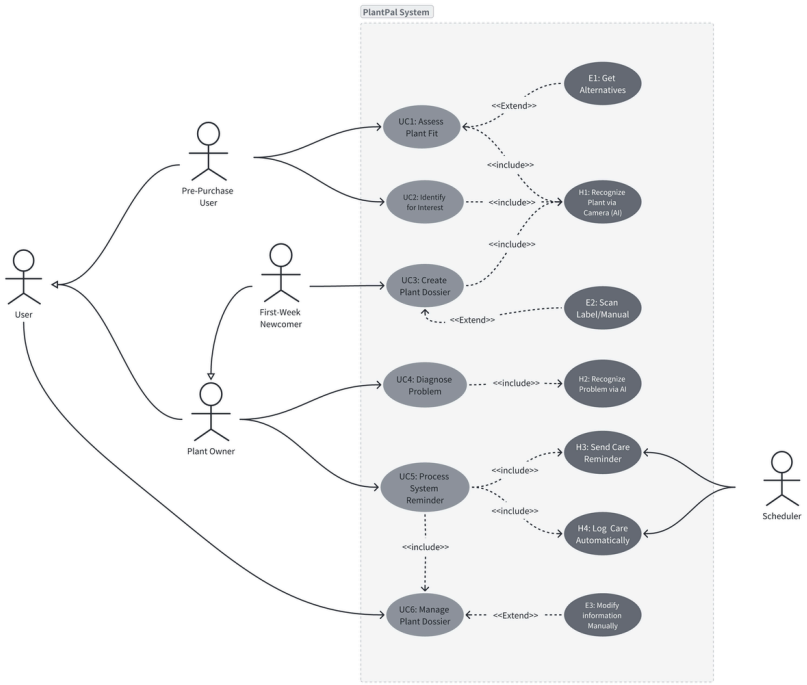
- Phase 0 – Foundation (W1–W2);
- Phase 1 – MVP (W3–W8);
- Phase 2 – Fit & Troubleshoot (W9–W12);
- Phase 3 – Quality & Scale (W13–W16).

3.3 Milestones

- **W2**: Foundations complete (project setup, privacy policy, core dataset, care schema).
- **W4**: ID v1 (top-k + confidence, manual confirm).
- **W6**: Dossier + Week-1 Quick-Start shipped.
- **W8**: MVP ready for internal beta (reminders, read-only care guides, analytics/crash reporting).
- **W10**: Fit wizard beta (light/time/pets/allergy).
- **W12**: Diagnosis v1 (lowest-risk first step + follow-up).
- **W14**: Cloud sync + CN/EN i18n; accessibility pass.
- **W16**: MVP GA candidate (content tooling + species expansion readiness).

4. Use case modeling and Business Process Modeling

Use case diagram:



4.1.1 Brief Use Case Description

Use Case ID	Name	Brief Description
UC1	**Assess Plant Fit**	Target User: With intent to care. User scans a plant, and the system provides a suitability assessment (light, pets, allergies) and alternative recommendations.
UC2	**Identify Plant Info**	Target User: No intent to care. User scans a plant, and the system provides only a concise species card (e.g., species, brief).
UC3	**Create a Dossier & Quick-Start**	Target User: Bought but not started. System uses AI to recognize the plant, manual, or label to create a dossier, and provides a clear "Quick-Start" checklist (placement, watering, tools, taboos).
UC4	**Diagnose Problem**	Target User: Already caring. User uploads a photo of an issue. The system provides one "lowest-risk first step" action instead of a list of possible diseases.
UC5	**Log Care Routine**	Target User: Already caring. The system proactively sends care reminders; after completion, the user can log the action to the plant's timeline with one tap.
UC6	**Manage Plant Dossier**	Spans all flows. User creates, views, and edits their "My Plants" dossier, which includes photos, events, and care plans.

4.1.2 Detailed Use Case Descriptions

UC1: Assess Plant Fit

Related Story: "When I see a plant I like at a store, I want to scan it to know if it 'fits my home'..."

Actor: Pre-Purchase User (With intent to care)

Preconditions: The app has camera permissions. The user has (optionally) preset their environment preferences.

- **Basic Flow:**

1. In a purchasing context, the user taps "Assess Fit."
2. The user takes or uploads a plant photo.
3. The system runs the AI model to identify the plant.
4. The system retrieves the user's environmental preferences (e.g., light, pets, allergy risks). If not set, it guides the user to input them.
5. Based on plant needs and user environment, the system outputs a fit assessment (e.g., "Great fit for you!" or "High Risk: Toxic to pets, not recommended").

- **Extensions:**
  - 3a. If recognition confidence is low, prompt the user to retake the photo or manually confirm from candidates.
  - 5a. If the assessment is "unsuitable," the system provides clear alternative recommendations with reasons.

UC2: Identify Plant Info

Related Story: Corresponds to the "No intent to care" need: "...just want to know information about the plant... provide a plant profile."

Actor: Pre-Purchase User (No intent to care) (16)

Preconditions: The app has camera permissions.

- **Basic Flow:**

1. The user taps "Identify Plant" or "Scan."
2. The user takes or uploads a plant photo.
3. The system runs the AI model to identify the plant.

4. The system returns a concise species card, including name, basic profile, and key characteristics.

- **Extensions:**
  - 3a. If recognition confidence is low, prompt the user to retake the photo or select from candidates.

UC3: Create Plant Dossier

Related Story: "When I first bring a plant home, I want to know how to get started quickly and also log my new plant."

Actor: First-Week Newcomer (Bought but not started)

Preconditions: The app has camera permissions.

- **Basic Flow:**

1. The user taps "Add New Plant."
2. The system prompts the user to identify the plant via photo, or (extension) scan the plant's manual/label.
3. The system runs AI recognition; the user confirms the species and (optionally) names the plant.
4. The system automatically creates a new plant dossier.
5. Simultaneously, the system generates and displays a "Week-1 Quick-Start" checklist on that dossier's page.
6. The checklist includes clear initial steps: e.g., placement, whether to water immediately, whether to repot, minimal tool suggestions, and clear "Don'ts".

UC4: Diagnose Problem

Related Story: "When I suspect my plant isn't doing well, I want one 'lowest-risk first step'..."

Actor: Routine Caregiver (Already caring)

Preconditions: At least one plant dossier exists.

- **Basic Flow:**

1. The user selects a plant from "My Plants" and taps "Diagnose Problem."
2. The user uploads a photo of the affected area or selects symptom descriptions (e.g., "Yellow leaves").
3. The system runs an initial diagnosis model to narrow possibilities based on the photo and symptom.
4. The system asks the user guiding check-up questions to gather information not visible in the photo. For example:
   - "Please poke your finger into the soil (about 2cm deep). Does it feel 'dry and hard,' 'slightly damp,' or 'very wet'?"
   - "Please check the underside of the leaves. Do you see 'tiny white dots' or 'fine webs'?"
5. The user completes the check-up based on the guidance and selects the corresponding feedback.
6. The system combines the "photo info" and "user's tactile feedback" to provide one "lowest-risk first step" action (e.g., "Stop watering immediately and move it to a more ventilated location").

- **Extensions:**
  - 6a. After providing the advice, the system automatically sets a follow-up reminder (e.g., "Please check the soil moisture again in 2 days").

UC5: Log Care Routine

Related Story: "...I want to know what needs to be done today, and also log my actions to the dossier."

Actor: Routine Caregiver (Already caring), System

Preconditions: A plant dossier exists and has an active care plan.

- **Basic Flow:**

1. The **System** generates care tasks (e.g., watering, fertilizing) based on plant type, rules, user's environment (weather, location), and time since the last action.
2. The **System** sends a push notification reminder at an appropriate time.
3. The **User** receives the reminder and performs the care action.
4. The **User** taps "Completed" or "Skip" in the app.
5. The **System** automatically logs this action to the plant's timeline.

- **Extensions:**
  - 5a. The user can proactively tap "Log" on the plant's dossier page to manually add a care action (e.g., "Repotted today") without a reminder.

UC6: Manage Plant Dossier

Related Story: Corresponds to all users' needs to view and maintain their plant records.

Actor: User (All types)

Preconditions: At least one plant dossier has been created via UC3.

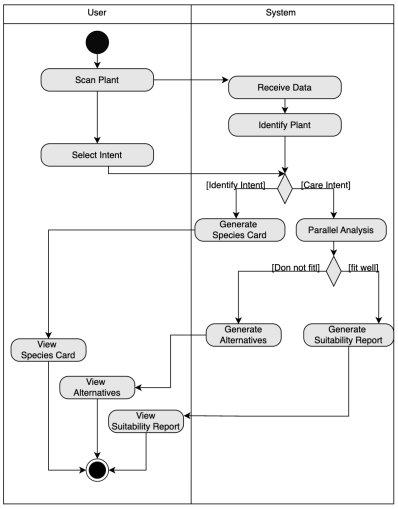
- **Basic Flow:**

1. The user navigates to the "My Plants" list.
2. The user can view a list of all created dossiers, including their nickname and status.
3. The user selects and enters a specific plant's dossier page.
4. The user can view the plant's detailed profile, care guide, and all photos.
5. The user can view a chronological log of care actions and events (Timeline).

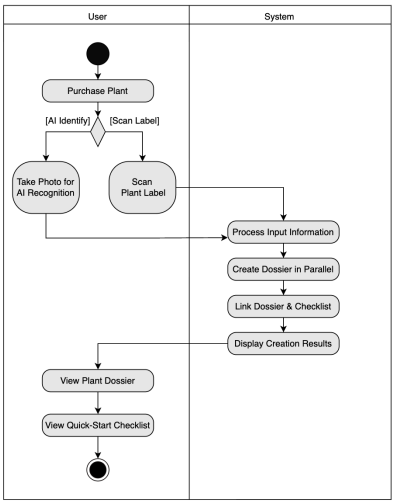
- **Extensions:**
  - 4a. The user can edit the plant's nickname, photos, or notes.

4.1.3 Activity Diagrams

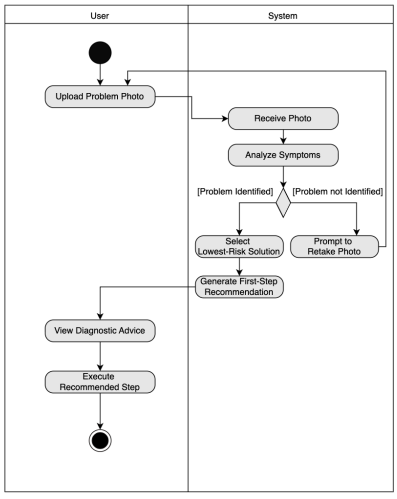
UC1 & UC2: Plant Scan & Assessment



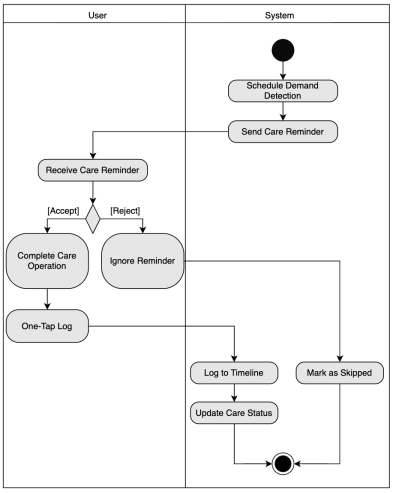
UC3: Create Dossier & Quick-Start



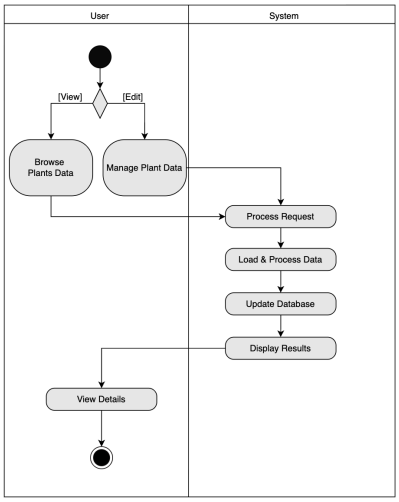
UC4: Diagnose Problem



UC5: Log Care Routine



UC6: Manage Plant Dossier



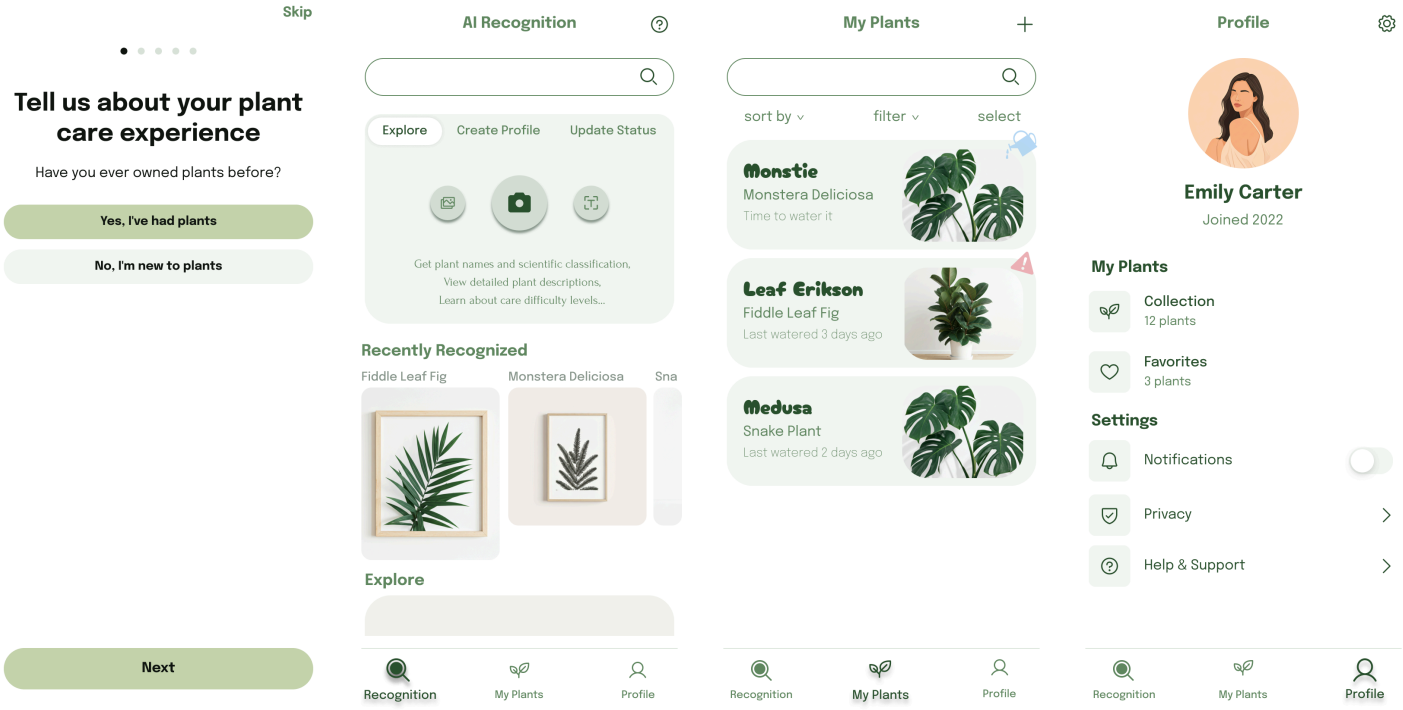
5. Glossary of terms

- **Dossier**: Structured plant record (species, photos, actions, notes).
- **Fit Assessment**: Suitability score from light/time/pets/allergy constraints.
- **Quick-Start**: Curated Week-1 checklist for new plants.
- **Care Guide**: Species profile (watering, light, temperature, toxicity, pitfalls).
- **Reminder**: Scheduled prompt for a care action.
- **Symptom**: Visual/text description used in diagnosis.
- **Top-k Predictions**: k most likely species returned by recognition.
- **Confidence Score**: Likelihood of a predicted species.
- **Quiet Hours**: Times when notifications are suppressed.
- **Timeline**: Chronological view of actions/observations.

6. Supplementary specification

- **Performance**: ID response ≤ 2 s (local) / ≤ 5 s (network); reminders within 1 min window.
- **Reliability**: ≥ 99.5% crash-free sessions; offline save and sync on reconnect.
- **Security & Privacy**: Local storage by default; explicit cloud opt-in; minimal PII; encryption at rest & in transit.
- **Usability & Accessibility**: WCAG contrast; large touch targets; simple copy; offline-first; CN/EN.
- **Compatibility**: iOS/Android latest + N-1; optional camera/gallery permissions.
- **Maintainability**: Modular model API; templated content; feature flags.
- **Data**: Species schema (name, light, watering, toxicity, issues); log schema (action, timestamp, notes, photo ref).
- **Compliance**: Platform privacy; COPPA/GDPR readiness; licensed species data.

7. Initial snapshots of the system’s user interface (mock-up)



UI-1 UI-2 UI-3 UI-4

Screenshot	Interface	Description
UI-1	Welcome Page	This page helps understand the user's plant care experience to provide personalized recommendations. The user can choose whether they have owned plants before and click "Next" to continue.
UI-2	Recognition Page	Provides a recognition feature where users can take or upload photos or text content. The AI can automatically identify plants or extract and interpret text (such as manuals, labels, etc.). The results display plant names, classifications, detailed descriptions, or text analysis. The page also shows recently recognized items and an explore section for discovering more interesting recognition results.
UI-3	My Plants Page	Displays the user's saved or added plants, including each plant's nickname, type, and the most recent watering time. It supports search, filter, and sort functions. If a plant needs watering or other care actions (such as fertilizing or pruning), the system will provide corresponding alerts and helpful reminders to assist users in taking better care of their plants.
UI-4	Profile Page	Shows the user's profile (avatar, name, join date) and plant collection information. It also includes settings for notifications, privacy, and help & support.

8. References

- **Hessayon, D.G. (2011). *The House Plant Expert*.** A classic practical guide covering common indoor species, routines, and troubleshooting—informing beginner-friendly checklists and species profiles (watering, light, toxicity).
- **Ferentinos, K.P. (2018). Deep learning models for plant disease detection and diagnosis. *Computers and Electronics in Agriculture*, 145, 311–318.** Surveys CNN-based disease recognition and informs design/expectations on mobile photos.
- **Mohanty, S.P., Hughes, D.P., & Salathé, M. (2016). Using deep learning for image-based plant disease detection. *Frontiers in Plant Science*, 7, 1419.** Demonstrates high accuracy on PlantVillage and highlights dataset bias/generalization risks.

9. Contributions of Team Members

Role	Owner	Key Responsibilities	Core Deliverables
PM & Ops (Product+QA)	Hengyu Jin	Scope/roadmap, KPIs, user research, release & QA	PRD & prototype, test checklist, weekly reports
Mobile Lead (App)	Qi Lin	Flutter/RN app, camera/gallery, offline & notifications, basic AR	Running app, timeline/reminders, export/offline
Backend & Rules (DevOps)	Baoyi Hu	APIs, scheduler/rules, weather/storage, CI/CD	REST APIs, scheduler, admin console
CV/ML & Data	Sirui Da	On-device (common), cloud long-tail, image-to-case, analytics	Inference services, Top-k results, KPI dashboard

10. Agile Requirements Artifacts

User Personas (mapped to segments)

- **Persona A1: Novice Chooser (Before Purchase · with intent)**—limited budget/time; wants fit score and alternatives from a single scan.
- **Persona A2: Info Explorer (Before Purchase · no intent)**—snaps rare plants for quick ID and a species card.

- **Persona B1: First-Week Newcomer (Bought, not started)**—needs explicit steps and taboos; dislikes long articles.
- **Persona C1: Routine Caregiver (Ongoing care)**—low-burden upkeep, timely reminders, simple triage, and records.

User Journeys: consolidated in 4.4 (A/B/C), ready to render as BPMN/Activity diagrams.

Impact Map (aligned to segments)
Goal: lower beginner failure rate → Behavior changes: assess before buying / complete Week-1 / follow reminders → Deliverables: fit assessment, Week-1 checklist, reminders & triage.

Backlog (bucketed by segment)

- **A (Before Purchase)**: A-1 robust ID; A-2 fit scoring & alternatives; A-3 minimal species cards.
- **B (Week-1)**: B-1 three-step Quick-Start; B-2 minimal toolkit hints; B-3 one-tap reminders.
- **C (Ongoing)**: C-1 action logs & timeline; C-2 smart schedule micro-adjustment; C-3 triage & follow-up.

Enablers: model API; species/rule configs; notification framework; content review workflow.