Vision and Scope Document

for

PlantIQ

Version 1.0 approved

Prepared by Yuliia Krasnokutska

KNHURE

24.10.2025

Table of Contents

Revision History

Name	Date	Reason For Changes	Version
Yuliia Krasnokutska	24.10.2025	Initial version	1.0

1. Business Requirements

1.1. Background

Indoor plants have become an essential part of modern living environments, contributing to comfort, aesthetics and well-being. However, caring for them requires regular attention and proper watering, which many people find difficult due to busy schedules, frequent travel or lack of plant care experience. As a result, plants often suffer from dehydration or overwatering.

The need has arisen for a solution that would simplify and automate the process of watering indoor plants, ensuring optimal soil moisture without constant human attention. Such a product would help users keep their plants healthy, save time and reduce the risk of human error in plant care.

1.2. Business Opportunity

The market for smart home devices for plant care is rapidly growing, as more people seek to integrate technology into daily life and improve comfort in their homes. Existing solutions often offer complex or expensive watering systems that can handle multiple plants at once, require connection to large infrastructures, or include unnecessary sensors (e.g., light, temperature), making them less user-friendly for the average consumer.

Existing products in the market include:

- *Smart Plant Ivy – an AI-driven planter equipped with sensors to monitor water, light and temperature. It features over 70 facial expressions to communicate plant needs and integrates with smart home ecosystems like Apple HomeKit, Google Home and Amazon Alexa. However, it is designed for single plants and may not offer the level of customization or data analytics that some users desire. Additionally, the price point is relatively high, making it less accessible for the average consumer;*
- *Xiaomi MiFlora – a Bluetooth-enabled soil sensor that tracks moisture, light, temperature, and fertility. While functional, it lacks automation features and requires manual data retrieval. The price is more affordable, but it may not provide the comprehensive solution that users are seeking;*
- *Click and Grow Smart Garden – an automated indoor garden system that provides optimal conditions for plant growth. However, it is designed for specific plant pods and doesn't offer customization for individual plants.*

The proposed product stands out from competitors with the following advantages:

- *One device per plant ensures precise watering control and allows personalized settings for each plant species;*
- *Automatic determination of optimal soil moisture for a specific plant species, with the option for manual adjustments;*
- *In addition to soil moisture monitoring, the device tracks light intensity, providing a comprehensive understanding of the plant's environment;*
- *The system calculates optimal watering schedules and light exposure for each plant species, with options for manual adjustments (e.g., plant name, water volume);*
- *A dedicated server collects and stores data from IoT devices, enabling real-time monitoring, analytics, and remote management via mobile and web applications;*

- *The IoT-device continues to operate autonomously if the internet is unavailable, monitoring soil moisture and light locally, and synchronizes stored data with the server when connectivity is restored;*
- *Users can monitor plant conditions, receive notifications and adjust settings from mobile or web apps, ensuring convenient plant care.*

The product targets urban indoor plant owners who have limited time for plant care, as well as people who value smart home solutions. Potential monetization includes:

- *Sales of hardware devices (IoT plant waterers);*
- *Premium mobile app features (e.g., plant condition analytics, moisture history, care recommendations);*
- *Partnerships with plant stores and online gardening platforms, allowing the product to be offered as a complete solution for plant buyers.*

1.3. Business Objectives and Success Criteria

Businness Objectives (BO):

BO-1: Launch the first version of the product with full integration of the IoT device, mobile app, and web interface within 12 months.

BO-2: Achieve at least 2000 active users within the first year after product launch.

BO-3: Sell at least 1000 hardware devices in the first year.

BO-4: Reduce users' manual watering effort or plant loss due to improper care by 20–25% within the first year.

BO-5: Ensure stable server operation with 99% uptime, including basic maintenance and monitoring.

Success Criteria (SC):

SC-1: Users can register and connect their IoT device via the mobile app without errors in 90-95% of cases.

SC-2: The device's autonomous operation during internet outages provides correct watering for at least 5 days.

SC-3: Optimal soil moisture levels for different plant species are maintained in 85-90% of cases, measured via sensors.

SC-4: Users receive timely notifications about plant status and adjust settings in real time through the apps.

SC-5: Positive user feedback and mobile app rating of at least 4.0 of 5 within the first year.

1.4. Customer or Market Needs

Indoor plant owners, especially in urban areas, often face difficulties maintaining proper watering schedules and monitoring plant health. Current solutions on the market are either expensive, overly complex, or not adaptable to individual plant needs. The proposed system aims to fill this gap by providing an affordable, easy-to-use, and intelligent solution for automated indoor plant watering.

Customer and market needs include:

1. *Users need a reliable system that can independently manage watering based on real-time soil moisture data without daily manual intervention;*
2. *Customers want a cost-effective device that is easy to install and maintain, unlike high-priced or overly complicated systems such as Smart Plant Ivy or Xiaomi MiFlora;*
3. *Each plant species requires specific soil moisture levels. Users need automatic detection of optimal parameters, with the ability to manually adjust watering frequency or light thresholds;*
4. *Users expect to view plant status, receive notifications, and control watering through both mobile and web applications;*
5. *The system must continue to operate autonomously during temporary internet outages and synchronize data with the server once connectivity is restored;*
6. *Users want insights into plant health trends, watering history, and personalized care recommendations;*
7. *The system should support multiple devices under one account, enabling users to manage several plants conveniently;*
8. *The mobile app must support both Android and iOS platforms, while the web interface should function on all major browsers.*

1.5. Business Risks

The development of the smart indoor plant watering system involves several business and technical risks that may affect project timelines, market entry and user adoption.

One of the main risks is strong market competition. Existing brands such as Xiaomi and Smart Plant Ivy already occupy a share of the smart plant care market. Competing with such companies may be challenging due to their established customer base and advanced production capabilities. To mitigate this, the product should focus on a narrower niche — affordable and easy-to-use devices designed for individual plants, offering clear value for ordinary home users rather than professional gardeners.

Another challenge is high initial development and production costs. Hardware design, IoT connectivity and server infrastructure require investment before the first sales occur. This can be reduced by developing a minimum viable product (MVP), using low-cost components and gradually scaling production after initial market validation.

User adoption risk is also significant. Many potential users are not familiar with smart plant care systems and may underestimate their usefulness. To address this, the project should emphasize user education, intuitive desigm and the clear benefits of automation (e.g., healthier plants, less effort).

Technical and infrastructure risks include potential failures in device–server communication, firmware bugs, or server downtime. These issues could reduce reliability and user trust. Preventive actions include careful testing, use of stable IoT protocols, and ensuring reliable server uptime through monitoring and automatic recovery systems.

Additionally, dependence on internet connectivity poses a risk in some environments. To minimize this, the system will support offline operation, storing sensor data locally and synchronizing it with the server once the connection is restored.

Finally, there are supply chain and data privacy concerns. Hardware components may become more expensive or temporarily unavailable, and users may worry about data safety. These risks can be mitigated by maintaining relationships with multiple suppliers, encrypting all communications, and complying with relevant data protection standards.

2. Vision of the Solution

2.1. Vision Statement

For urban indoor plant owners and smart home enthusiasts who struggle to maintain healthy plants due to lack of time, inconsistent watering or limited knowledge, the PlantIQ is an intelligent, affordable and user-friendly device that automates plant care by monitoring soil moisture and light in real time, and controlling watering through a mobile or web app.

Unlike expensive and complex multi-plant systems such as Smart Plant Ivy or Xiaomi MiFlora, our product offers a simple, per-plant solution with precise control, adaptive watering and cloud-based analytics, allowing users to maintain optimal plant health effortlessly.

Our vision is to make smart plant care accessible to everyone — creating a world where every indoor plant thrives and technology supports sustainability, water efficiency and comfort in everyday life.

2.2. Major Features

MF-1. Automatic Watering Control. The system automatically controls watering based on real-time soil moisture data, ensuring that each plant receives the optimal amount of water.

MF-2. Light Monitoring. A built-in light sensor measures light intensity, helping users understand whether their plants receive sufficient illumination.

MF-3. Plant Profile Management. Users can create and manage individual plant profiles by specifying plant name, type, and location. The system automatically determines optimal soil moisture levels for each species.

MF-4. Manual Settings Adjustment. Users can manually configure parameters such as desired moisture threshold, watering duration, and watering frequency to customize plant care.

MF-5. Real-Time Monitoring via Mobile and Web Applications. A synchronized mobile and web interface allows users to view soil moisture, light levels, and watering history in real time.

MF-6. Notifications and Alerts. The system sends notifications about critical plant conditions (e.g., low moisture, excessive light or device errors) through the mobile and web applications.

MF-7. Offline Operation Mode. The device continues functioning autonomously when the internet connection is unavailable, storing data locally and synchronizing it with the server once connectivity is restored.

MF-8. Data Storage and Analytics. Collected data is stored on the server, enabling users to review trends, analyze watering efficiency, and receive recommendations for better plant care.

MF-9. Multi-Device Support. Users can connect and manage multiple IoT watering devices from a single account, making the system scalable for several plants or locations.

2.3. Assumptions and Dependencies

Assumptions (A):

A-1. Users have access to a stable Wi-Fi network for device setup, synchronization and regular data transmission.

A-2. Users possess a smartphone or computer with internet access to use the mobile and web application.

A-3. Each IoT watering device is assigned to one plant (or pot) and configured individually.

A-4. The IoT device is powered either through a constant power supply or a rechargeable battery with sufficient capacity for autonomous operation.

A-5. Users will provide accurate plant information (e.g., species, name) to enable correct automatic parameter selection.

A-6. The system will primarily be used in indoor environments with moderate temperature and humidity conditions.

A-7. Collected data (e.g., moisture, light levels) will be used solely for plant monitoring and will not include sensitive personal information.

Dependencies (D):

D-1. Reliable server infrastructure for data storage, synchronization, and analytics.

D-2. Stable operation of third-party cloud services or APIs (if used for hosting, notifications, or analytics).

D-3. Availability of necessary hardware components (e.g., soil moisture sensors, light sensors, pumps, microcontrollers) on the market.

D-4. Timely firmware and software updates to ensure stable operation and maintain security.

3. Scope and Limitations

3.1. Scope of Initial Release

The initial release will focus on delivering a stable, functional and user-friendly foundation that combines IoT hardware, backend infrastructure and client applications (mobile and web). The goal is to provide users with automated plant watering, real-time monitoring and reliable data management while maintaining scalability for future feature expansion.

1. *IoT Device Functionality*

- *Automated watering based on soil moisture sensor readings;*
- *Measurement of light intensity to assess plant illumination;*
- *Local decision-making for watering cycles (autonomous mode);*
- *Data storage during offline periods and synchronization with the server once internet access is restored.*

2. *Backend System*

- *Centralized data storage for all devices and users;*
- *RESTful API for communication between IoT devices, mobile and web applications;*
- *Business logic implementation for moisture and light data processing, automatic watering threshold calculation based on plant species, user account management and device linking;*
- *Notification service for alerts (e.g., low moisture, poor light conditions, connection issues);*
- *Basic admin panel for monitoring devices, users and system health;*
- *Data protection and user authentication mechanisms.*

3. *Mobile Application*

- *User registration and login;*
- *Device pairing and setup via Wi-Fi;*
- *Real-time dashboard with plant status (moisture, light, last watering);*
- *Manual watering control and parameter adjustment;*
- *Push notifications for important events (e.g., low moisture);*
- *Data protection and user authentication mechanisms.*

4. Web Application
- *Same core functionality as the mobile app: user authentication, plant monitoring, and manual control;*
- *Browser compatibility (Chrome, Firefox, Edge, Safari).*

3.2. Scope of Subsequent Releases

1. Enhanced IoT Device Capabilities
- *Integration of additional environmental sensors (temperature and humidity);*
- *Adaptive watering algorithms that consider light intensity, soil type, and plant growth stage;*
- *Battery optimization and power-saving modes;*
- *Support for one device controlling multiple plants or larger containers (e.g., flowerbeds);*
- *Remote firmware update and diagnostics through the mobile or web app.*

2. Advanced Data Analytics and Recommendations
- *AI-driven plant health analytics based on long-term data trends;*
- *Personalized watering schedules and care recommendations;*
- *Visualization dashboards with detailed graphs for moisture, light, and watering patterns;*
- *Data export to CSV or PDF for advanced users.*

3. Mobile and Web Application Enhancements
- *Multi-language localization (Ukrainian, Polish, German, etc.);*
- *Integration with smart home assistants (Google Home, Amazon Alexa, Apple HomeKit);*
- *Shared access for multiple users under one account (e.g., family or office management);*
- *Cloud-based user backups and device settings synchronization.*

4. Server and System Scalability
- *Migration to distributed microservices architecture for better performance and scalability;*
- *Implementation of load balancing and advanced monitoring tools;*
- *Expansion of the notification system (email and messenger alerts).*

5. Business and Community Features
- *Integration with plant identification APIs for automatic species recognition;*
- *Partnership features for plant shops and care service providers;*
- *Community platform for plant owners to share care experiences and tips.*

3.3. Limitations and Exclusions

LE-1. The device is designed for indoor use only and may not function properly under outdoor conditions such as direct rain, extreme temperatures or high humidity.
LE-2. The system can monitor and control watering for one plant per device. Support for multiple plants from a single device is not included in the initial version.
LE-3. The IoT device relies on Wi-Fi connectivity for data synchronization with the server. In offline mode, only basic autonomous watering and local data storage are available.
LE-4. The battery life and watering capacity are limited by the physical size of the device and water tank, requiring periodic maintenance by the user.
LE-5. The accuracy of light and moisture measurements may vary depending on sensor quality, placement and soil type.
LE-6. The mobile and web applications require internet access and a registered user account to enable full functionality such as analytics, history and notifications.
LE-7. The system does not include automated fertilizer dispensing or nutrient monitoring in the initial release.
LE-8. The product does not support multiple-user simultaneous access management for shared plant ownership.

4. Business Context

4.1. Stakeholder Profiles

Stakeholder	Major Value	Attitudes	Major Interests	Constraints
Plant Owners	*keep plants healthy with minimal effort*	*expect easy setup, mobile accessibility and reliable automation*	*automated watering; mobile control; notifications; cost efficiency*	*affordable price; limited technical skills; device must work without constant Internet*
Plant Enthusiasts	*advanced control and analytics for plant care*	*expect customizable and detailed features.*	*sensor calibration; extensive plant database; historical data tracking; manual adjustment options*	*multi-plant support and integration with other smart devices*
Retail Partners	*increased sales volume; ability to offer a complete smart solution to customers*	*interested if the product is scalable and affordable*	*favorable wholesale pricing and terms; shelf-ready packaging; staff training materials; reliable supply chain*	*require a favorable wholesale terms; limited physical shelf space; product must be retail-ready*

4.2. Project Priorities

Dimension	Driver (state objective)	Constraint (state limits)	Degree of Freedom (state allowable range)
Schedule	*release MVP (IoT, Backend) by Mid-December; release 1.0 (Full Stack) to be available within 12 months*		
Features	*automatic watering control and offline operation must be fully functional*		*advanced analytics and multi-language support can be deferred*
Quality	*achieve stable server operation with 99% uptime*	*90-95% of user acceptance tests must pass for release 1.0*	*the number of supported plant species in the initial database can be limited.*
Cost			*hosting costs can be temporarily increased if required to meet the 99% uptime objective*

4.3. Operating Environment

Users are expected to be distributed globally, primarily in urban environments. Time zone differences will be handled by the server through synchronized UTC-based timestamps for watering schedules and data logs.

Users should be able to access the system at any time via mobile and web applications. Continuous availability of the server is desirable but not critical — the IoT device is designed to function autonomously for a limited period in case of network or power loss, storing data locally until synchronization is restored.

Data is generated by IoT plant watering devices (e.g., soil moisture readings, watering logs) and sent to the central server for processing, analytics and visualization. The data flow is primarily one-directional from devices to the cloud, with occasional commands (e.g., configuration updates) sent back from the server.

IoT devices should be able to transmit sensor data every 15–30 minutes with minimal latency (<2 seconds per request). The backend API must respond to client requests within 500–800 ms under normal load. Mobile and web applications must render dashboards and sensor data within 2 seconds.

The system must handle temporary disconnections gracefully, ensuring that IoT devices buffer unsent data and automatically resync once a connection is available.

All communications between IoT devices, the backend, and clients must be encrypted using HTTPS (TLS 1.2 or higher). Each device will be registered with a unique key to prevent unauthorized access. User accounts and plant data must be securely stored in a relational database with authentication and role-based access control.

Technology Stack:

1. *Backend: ASP.NET Core, Entity Framework Core, PostgreSQL.*
2. *Frontend: Flutter.*
3. *Mobile: Kotlin (Android) or/and Swift (iOS).*
4. *IoT Device: Arduino Core or PlatformIO or CircuitPython.*
5. *API: RESTful API.*

The system should continue basic operation (watering according to last known settings) even when disconnected from the internet. Synchronization and updates will resume automatically once connectivity returns.