

COS214 Project

Report

Group: Chaos Compilers

u23608821 - Megan Lai
u23544563 - Inge Keyser
u24827313 - Blessing Gibendi
u24607526 - Divo Köhler
u23526964 - Langa Vakalisa

1. Research of the day to day operations of a nursery and the environmental factors that affect plants

This report focuses specifically on nurseries, plant stock, and biomes relevant to the Pretoria region in South Africa. The successful operation of a commercial nursery is predicated on three integrated components: Plant Care, Business Management and Commercial Viability, and Community Engagement and Customer Relations.

1.1. Horticultural Expertise and Plant Care (Staff):

This component relies on specialized staff ("Staff") possessing comprehensive botanical knowledge. Their primary responsibilities include the intricate care of plant inventory to ensure optimal vitality. This includes all phases of the plant lifecycle, from correct planting protocols to sustainable harvesting techniques, tailored to the specific needs of diverse plant species and their microenvironments.

1.2. Business Management and Commercial Viability:

Beyond cultivation, commercial success requires robust management. This involves ensuring optimal stock levels, efficient operational management, and the necessary administrative functions to sustain the business. This oversight guarantees the enterprise remains commercially viable and capable of meeting market demand.

1.3. Community Engagement and Customer Relations (Staff):

The market viability of the nursery depends on its customer base. Staff serve a critical role in assisting consumers by providing expert advice, handling sales transactions (checkout), and managing customer inquiries. This establishes the essential link between the business and the purchasing community.

Staff members fulfill essential dual roles, integrating direct plant care with customer service and administrative support. Their duties are critical to both the biological and commercial health of the nursery.

The most efficient strategy for achieving rapid and sustained stock growth in the Pretoria region is to prioritize native plant species, which are naturally adapted to the local environment.

The core South African flora that thrives here is categorized into three resilient types: succulents (like the Elephant Bush and Aloe Vera), which flourish in dry, warm conditions; drought-resistant flowering plants (such as the indigenous Protea,

Agapanthus, and Century Plant); and resilient tree species (including the well-adapted Jacaranda and African Sumac).

To provide consumers with accessible and hardy options, herbs are also stocked, known for their ability to recover quickly from neglect. However, consumer demand often extends to non-native ornamental plants, such as Roses or Petunias. While planting native stock ensures ecosystem stability and a reliable inventory, cultivating these non-native species requires staff to exert precise control over the microclimate.

To successfully meet this demand, the nursery must meticulously manage environmental factors, including sunlight distribution, humidity levels, water consumption, soil type, and the manipulation of blooming seasons. This dual approach - leveraging the resilience of native plants while managing the environment for desired non-native species - is key to commercial success.

2. Design Influences

The core design of our system was directly influenced by three key components: Plant Selection and Customer Customization, Horticultural Lifecycle Management, and Operational Staffing Structure.

2.1. Plant Merchandising and Customer Aesthetics

Our approach to plant sales was heavily influenced by the bouquet concept, recognizing that customers desire multiple plant varieties in a single purchase. The most effective solution was the inclusion of a specialized decorator system. This feature allows for the aesthetic combination of different plant types without physically coupling them, offering the visual appeal of a bouquet while maintaining the individual integrity and distinct care requirements of each plant.

2.2. Horticultural Lifecycle Management

Environmental factors, particularly weather and lifecycle duration, significantly shaped the design. This led to the integration of perennial plants (such as succulents and slow-growing trees) into the stock system. These plants, which persist across multiple seasons, provide stable inventory and reflect the real-world complexity of plant growth cycles.

2.3. Staff Specialization and Operational Efficiency

The diverse requirements of running a commercial enterprise directly influenced our staffing structure. To optimize efficiency and competence across all functions, we implemented a system of job specialization. This ensures that

employees are expertly trained for specific roles, improving the quality of both plant care and business management.

2.4. Customer Interaction and System Robustness

Integrating the abstract concept of the customer posed a significant design challenge. We resolved this by programming for customer dissatisfaction, where customers who cannot find a desired item will express their disappointment and leave, rather than entering a persistent, unresolvable waiting state (a "soft-lock"). This design choice not only adds realism but also significantly enhances the system's robustness and flow.

3. Assumptions made:

- We assume that the customers will always have enough money to buy the plants, therefore there will be no refusal of service or requirement of prices for plants.
- We assume that when first starting the game, there is a default plant in stock to sell.
- We assume the customer knows what plants we have stock and that they know they need to go to the help desk if they require help.
- The soil type is given by a number for the three different soil types:
 1. Loamy soil is the most common used by most plants.
 2. Succulent soil, which is a mix of coarse sand, perlite and normal soil.
 3. Peat soil is used for herbs as well as some trees.
 4. It is assumed the gardeners will use the correct soil type.
- Using water comes with two states for a plant:
 1. Because of the timer changing once in a season(meaning the timer triggers every 3 months), plants who are watered once in the season will live and plants that have not been watered die. A plant may be watered more than once a season and the plant will still live except for succulent plants which die if they are watered more than once.
 2. The plant has either not been watered or has been watered.
- Amount of sunlight is ranked in the same way with 3 possibilities:
 1. Complete sun.
 2. Semi shaded.
 3. No/minimal sunlight.

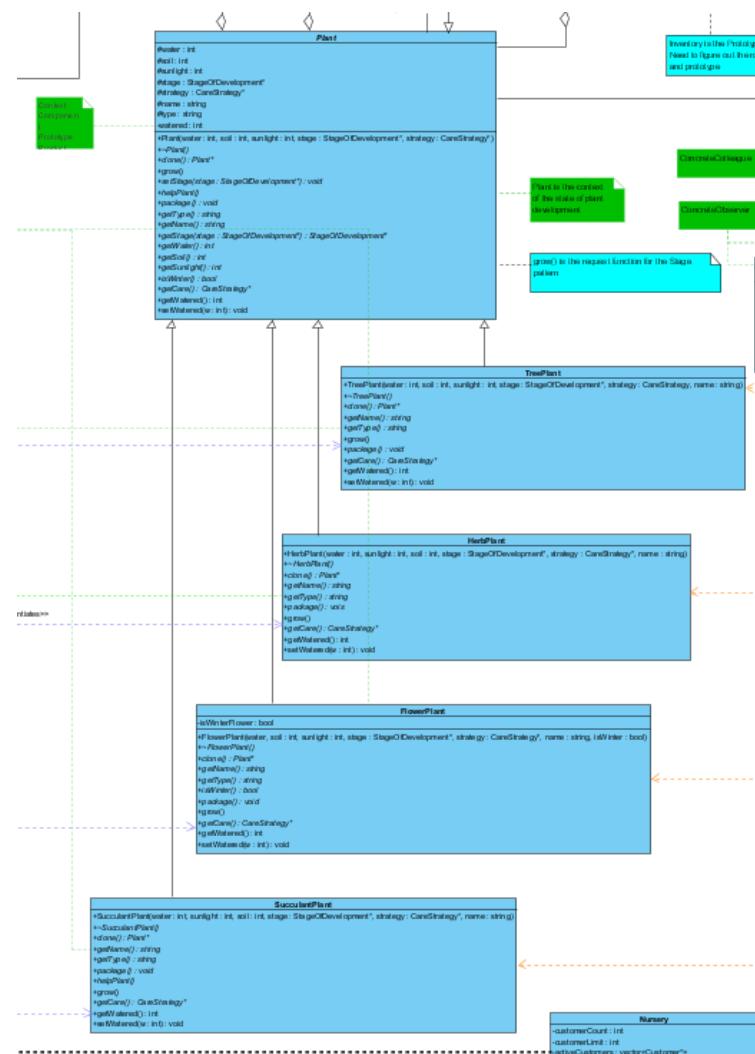
- 4. Different amounts of sunlight is assigned to different plant types but it is assumed that the gardeners will ensure they receive the correct amount of sunlight.
- We made the assumption that if something is perennial, it will grow and die after one season cycle.
- Flowers bloom mainly in the summer or winter. Spring and autumn are wilting and growing seasons, but still have a change of plants blooming during their season
- Flowers are the only plants to be either winter or summer plants, the rest are perennial.
- Plants that will be grown and sold in our nursery:
 (Format: Plant name, Seeds planted season, Blooms season (winter or summer or perennial)).

 - Succulents:
 - Elephant bush, any season, perennial
 - Candelabra Aloe vera, any season, perennial
 - Jade plant, any season, perennial
 - red pagoda, any season, perennial
 - Portulaca, any season, perennial
 - Flowering plants:
 - Bush lily, winter, summer
 - Wild hibiscus ,summer, winter
 - Agapanthus, winter, summer
 - King Protea, summer, winter
 - Rose, summer,winter
 - Daisy, winter ,summer
 - Poppy, winter ,summer
 - Orchid, summer, winter
 - Trees:
 - Jacaranda, winter, perennial
 - Acacia , summer, perennial
 - Herbs:
 - Thyme, Oregon, chives, parsley, sage, summer, perennial.

5. Design Patterns Used and Their Functional Requirements:

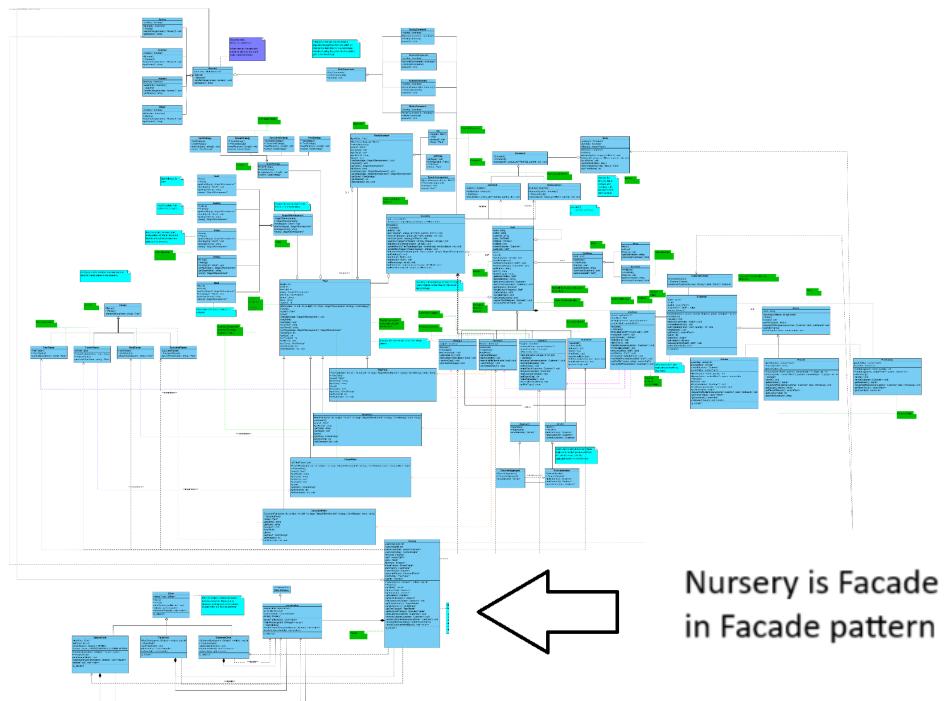
4.1. Prototype

The inventory requires many plants to be grown within a set list of plants. The creation of new flowers is very expensive computation wise, hence, cloning allows for the right stock to be added to stock and inventory.



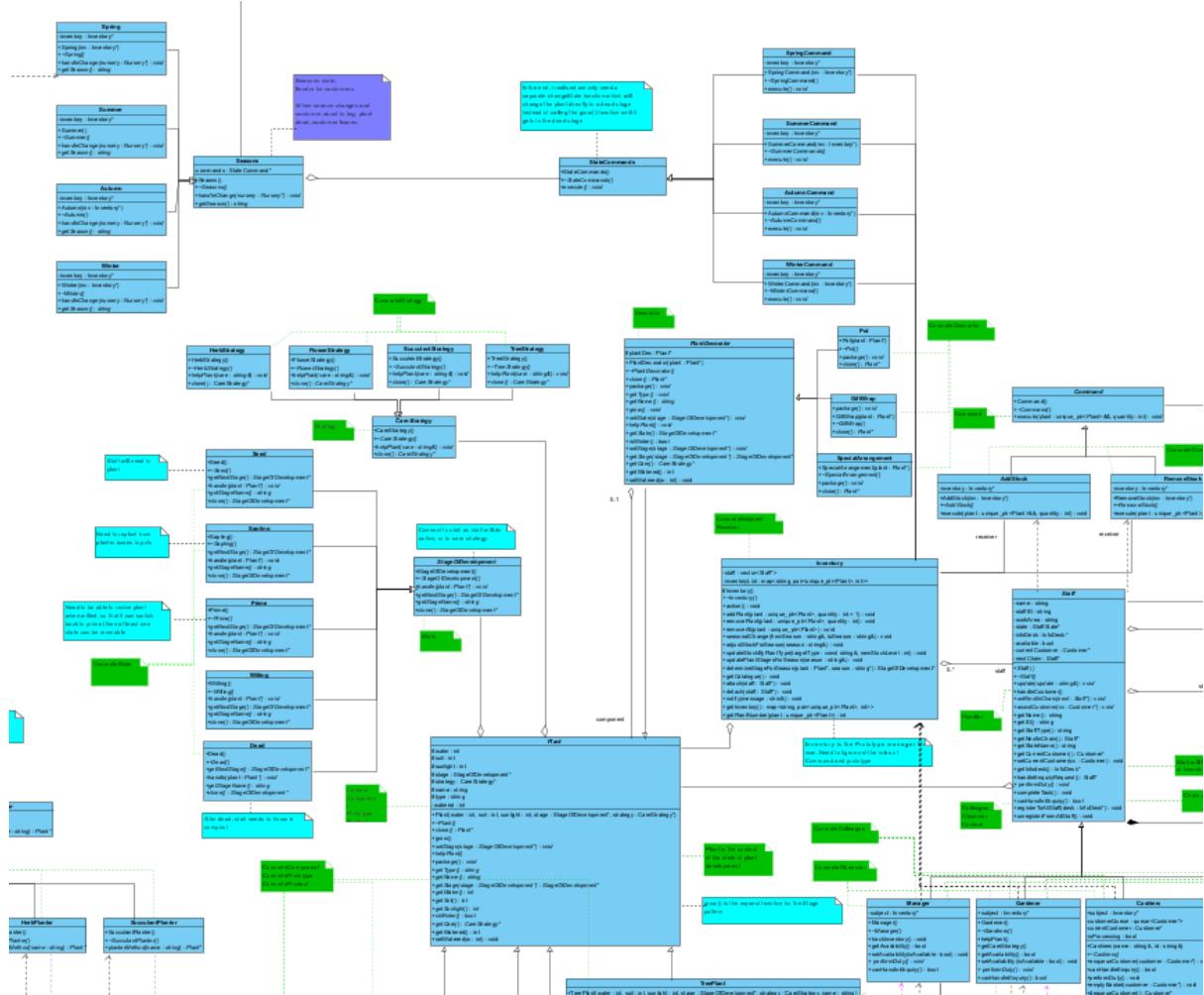
4.2. Facade

The system will initialise the initial objects of the nursery so that the application can run. This includes the different seasons, the plant factories, the clock objects, staff members and default plants in stock. Furthermore, this system will manage the changes in seasons, the creation of customers and the plant growth.



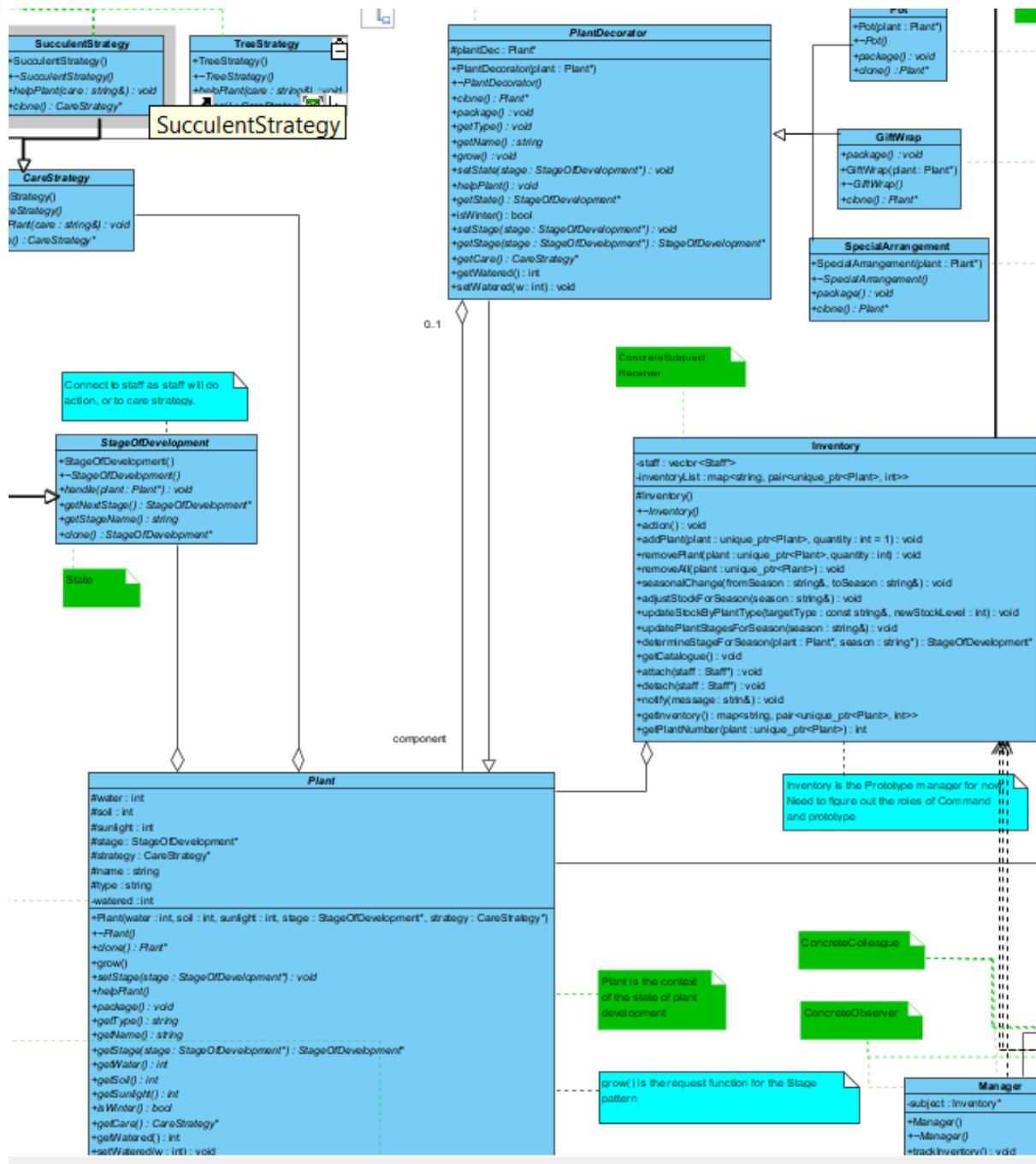
4.3. Observer

The system needs to be aware of both the current season and the current state of the plants as time passes in order to remove dead plants from inventory, plant seeds, harvest and add to the inventory and notify a gardener when a plant needs a specific care strategy.



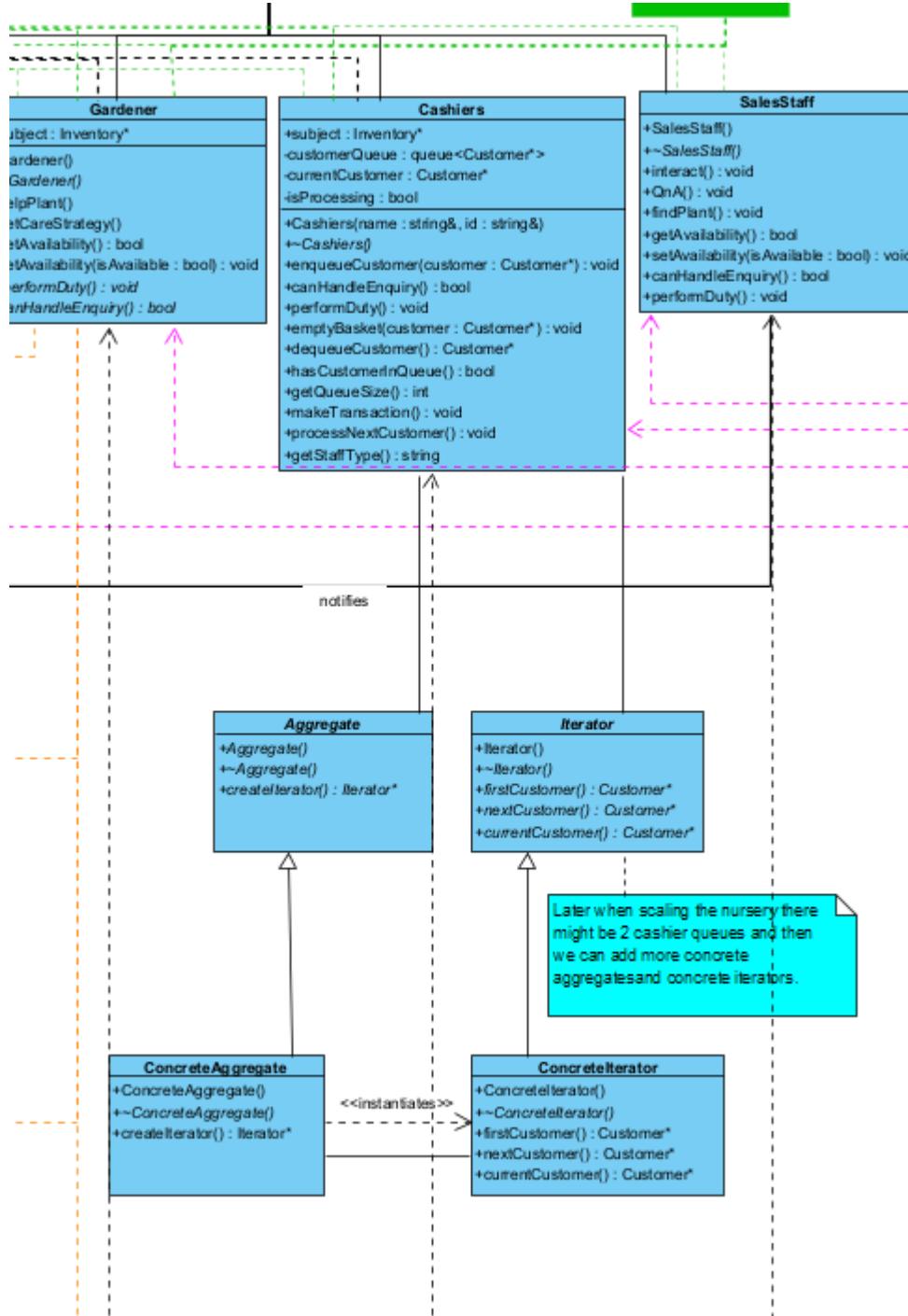
4.4. Decorator

The system requires a way to provide bouquets of different plants and decorative aspects to the plant bundle such as pots and gift wrapping, as customers do not always buy types of plants in isolation.



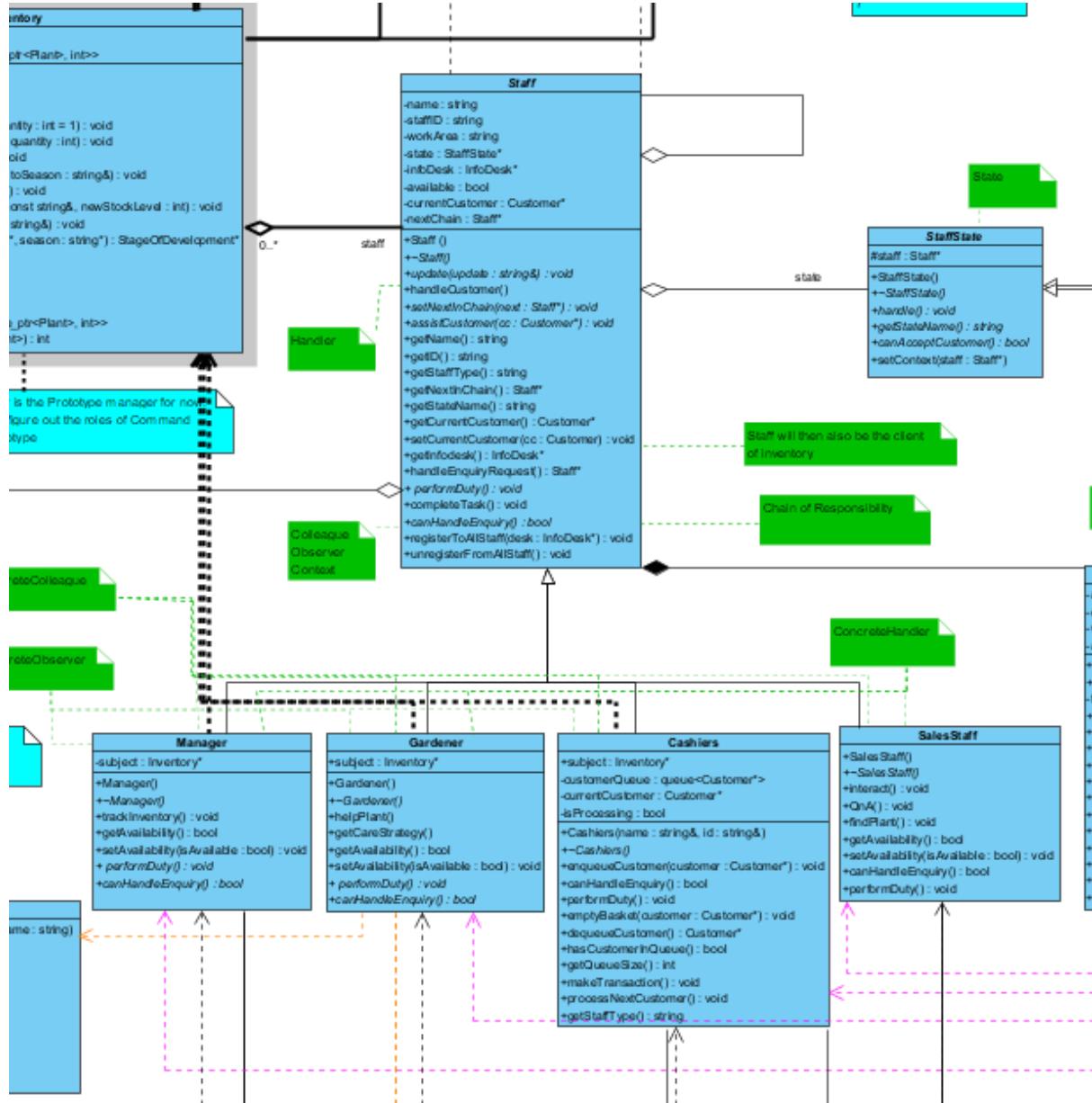
4.5. Iterator

The system will iterate through the customers that are waiting in a queue to purchase their plants. If a customer has a dead plant this will be removed from their cart, if their cart is empty they leave.



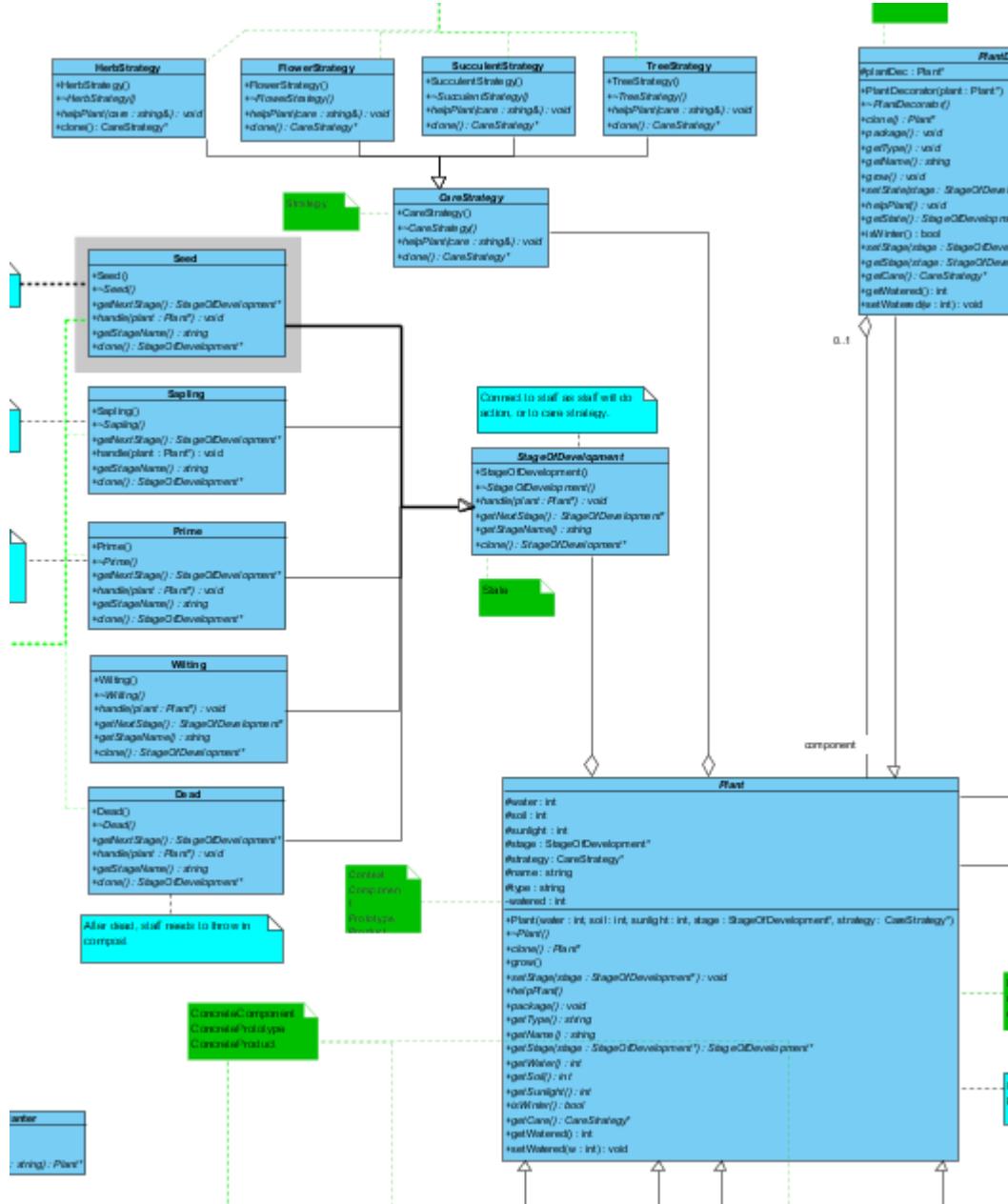
4.6. Chain of Responsibility

Staff need to be able to assist customers but not all staff have the capacity to take care of customers, ensure the plants are cared for, and be cashiers, but a customer could need all these different types of staff depending on their individual needs.

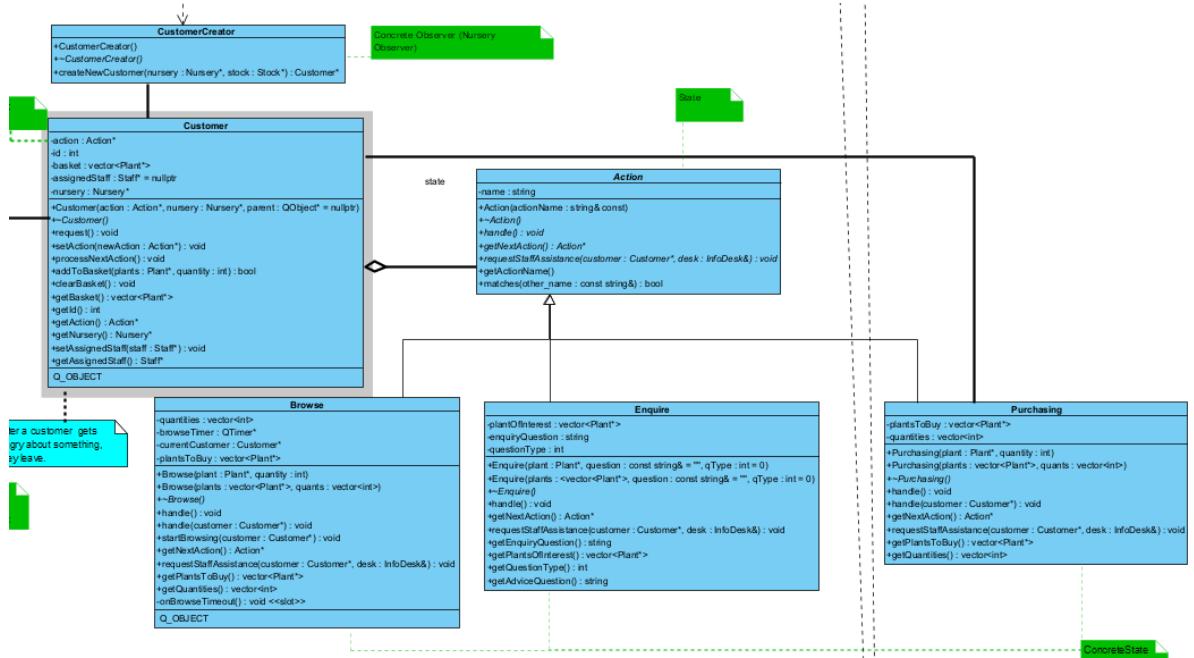


4.7. State

The system needs to be able to track the lifecycle of the plants to ensure that there is stock to sell and what plants to remove once out of season (dead) as well as to know when to plant and harvest the plants based on their stage of development.

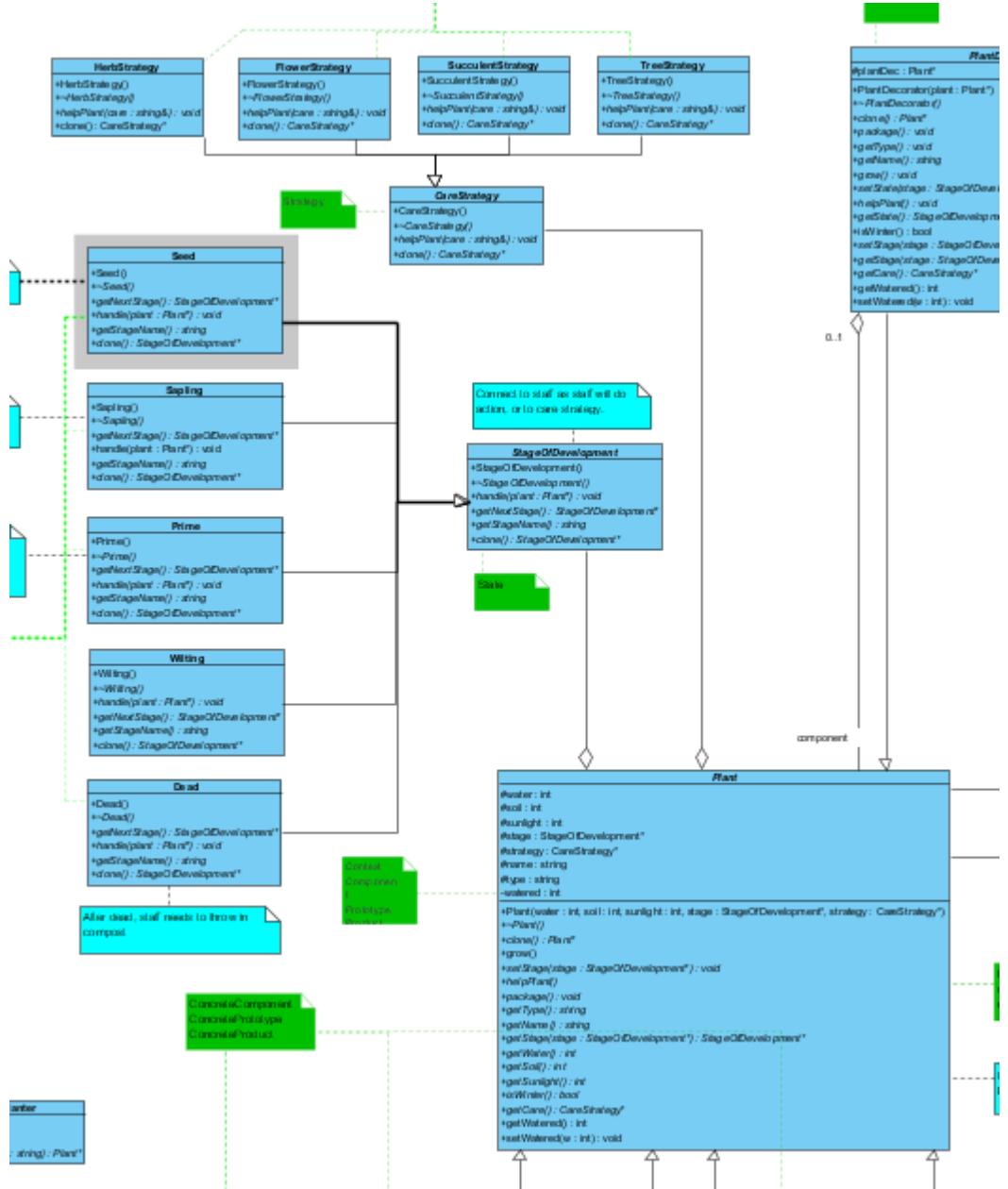


The system needs to accommodate the different needs of a customer to ensure customer satisfaction. A customer has 3 states in which they can be in, namely browse, enquire or purchasing.



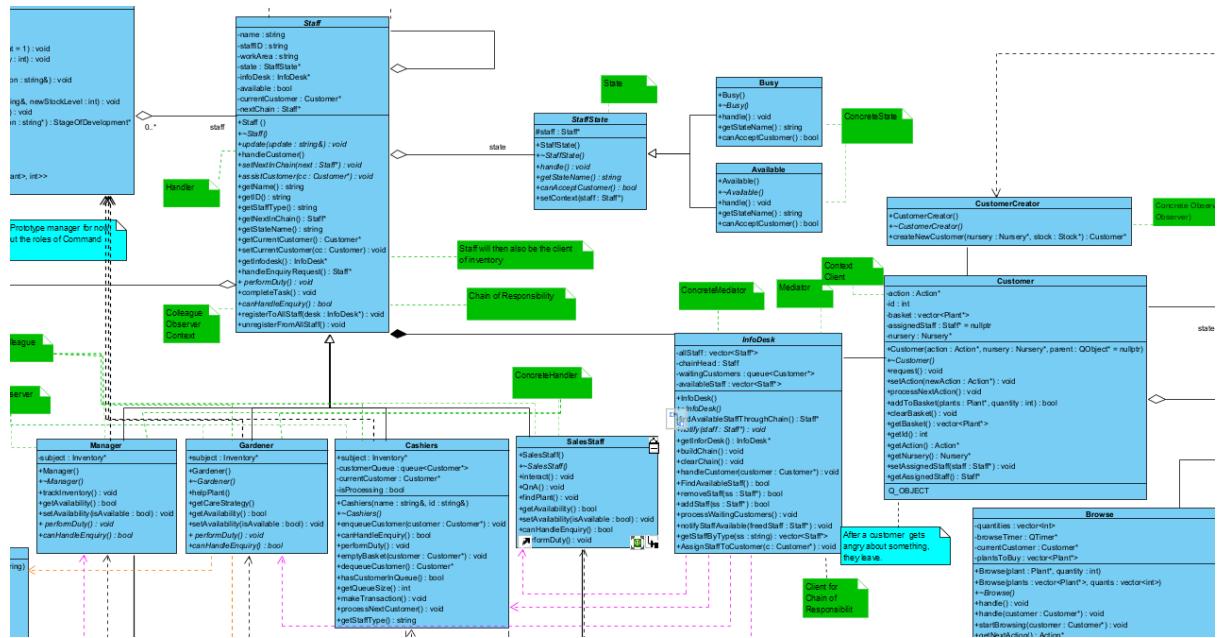
4.8. Strategy

The system needs to provide a variety of different types of plants to sell all year round. These plant types require a different care strategy in order for them to grow and keep alive.



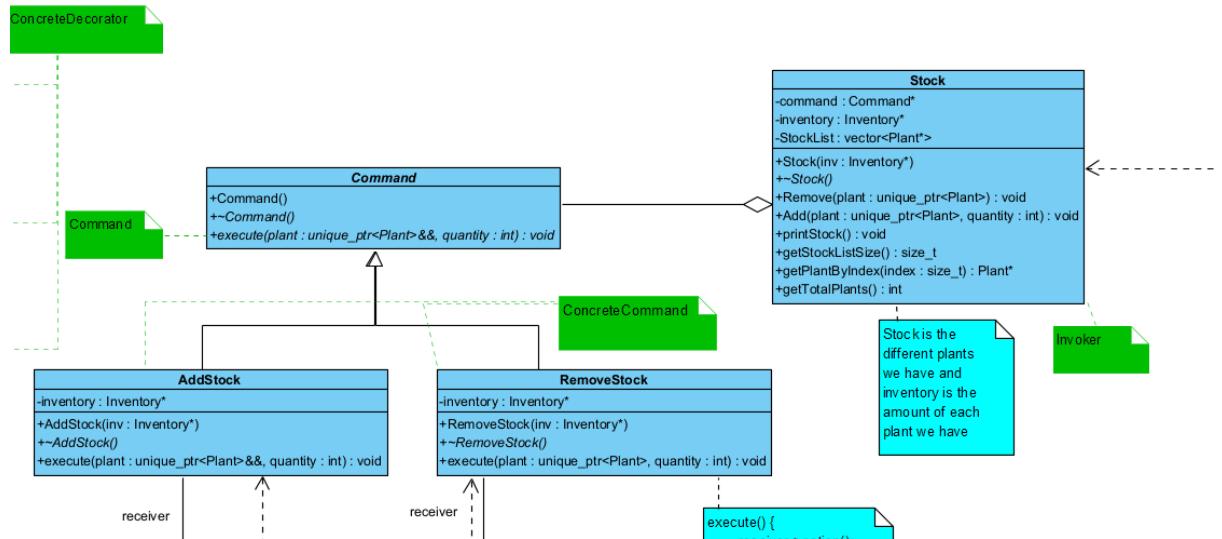
4.9. Mediator

The system requires a way for staff and customers to interact with each other without allowing direct communication with all staff (staff with many customers or customers to other customers). The info desk acts as a mediator to ensure no coupling has taken place.

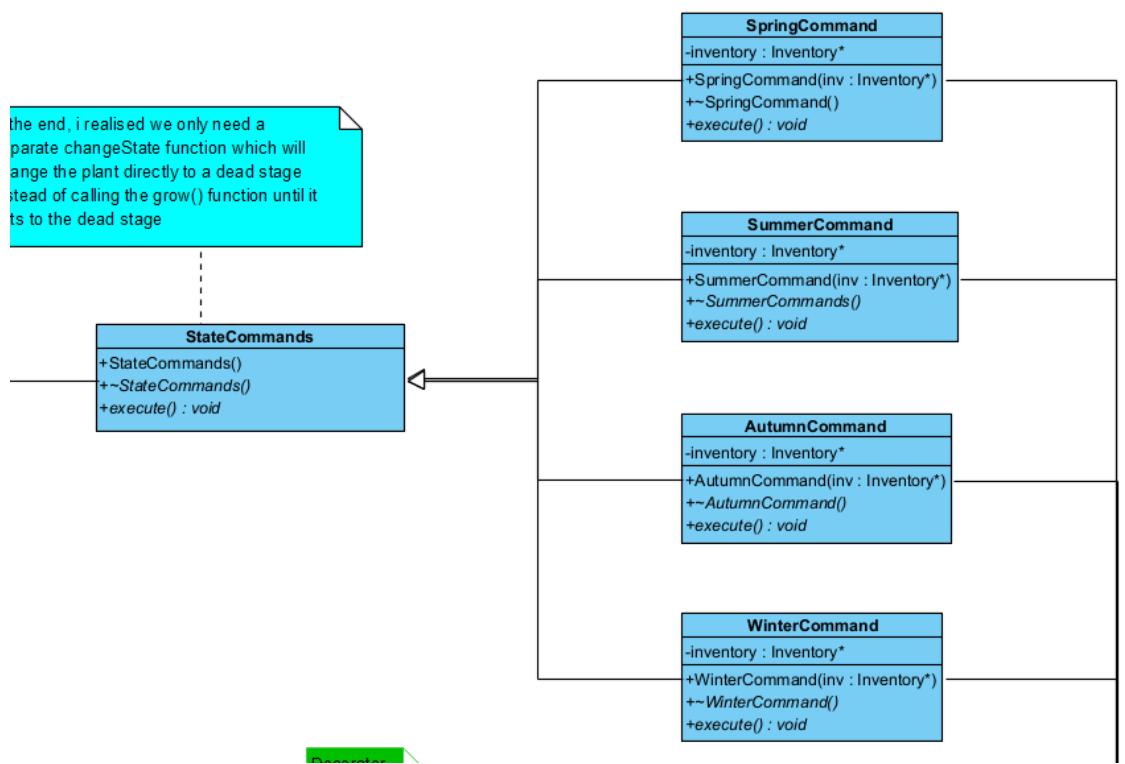


4.10. Command

The system needs to be able to add and remove stock from the inventory representing the inflow of plants when new stock of plants is added to the inventory and the outflow of plants when plants have been purchased by customers Not sure about this one need to ask blessing and check.

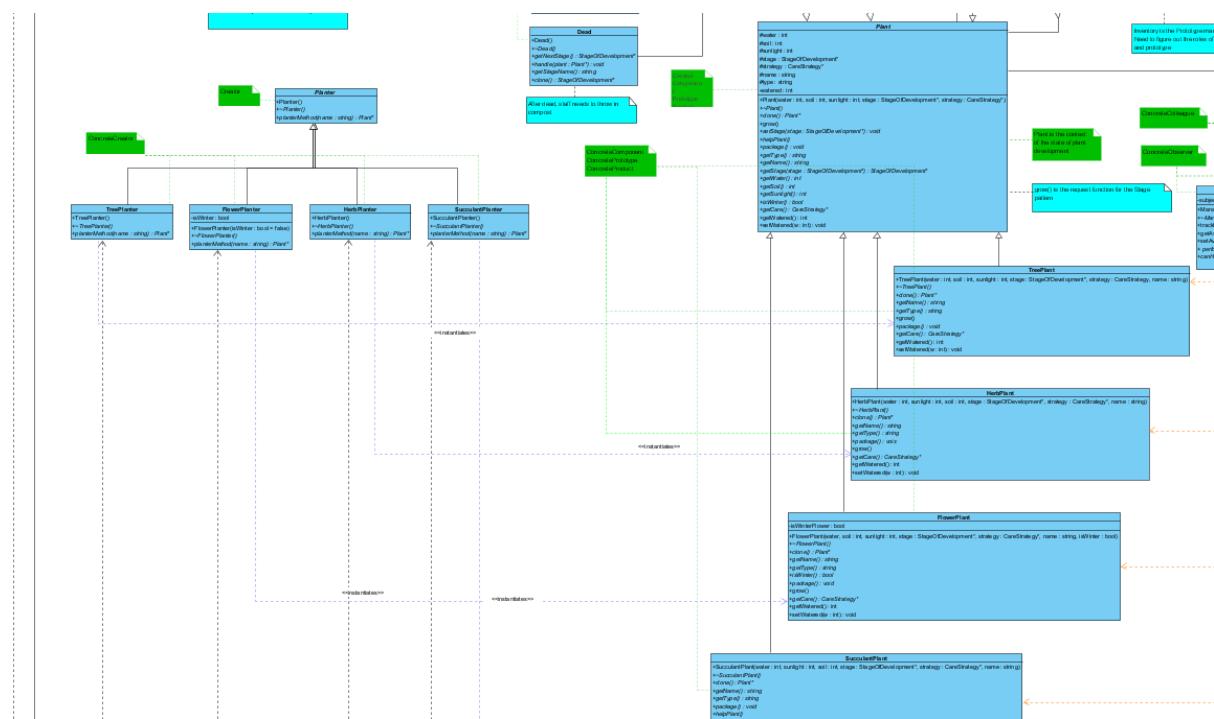


The system removes stock from inventory as plants die because of the season, each season has its own concrete command.



4.11. Factory Method

The nursery requires a way to produce plant objects that have many varying factors such as the type of plant, soil type, ect. in order to have stock.

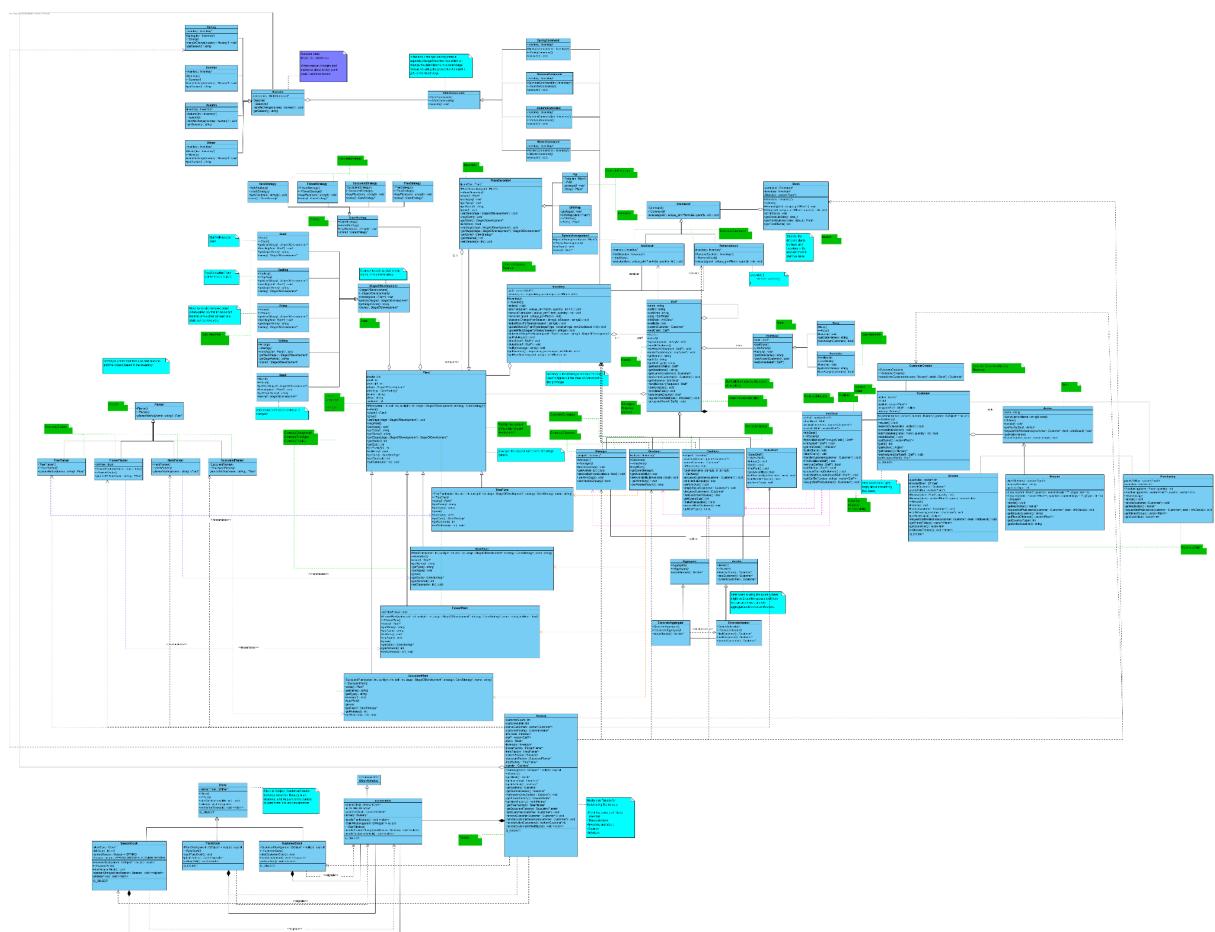


5. Non-functional Requirements:

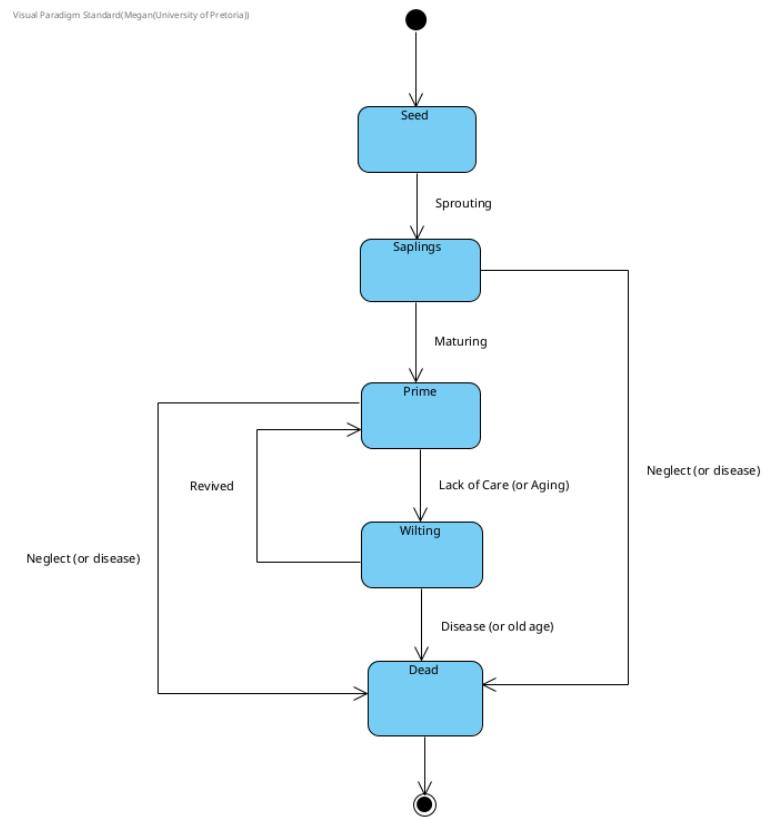
1. **Maintainability:** The system shall have a modular design so that new plant types will be able to be added without changing the existing plant classes.
 2. **Reliability:** The system will handle invalid user inputs with appropriate error messages to limit system downtime.
 3. **Extensibility:** The system will allow the addition of new plant care strategies and plant decorations without having to change the original Strategy and Decorator design patterns.

6. UML Diagrams

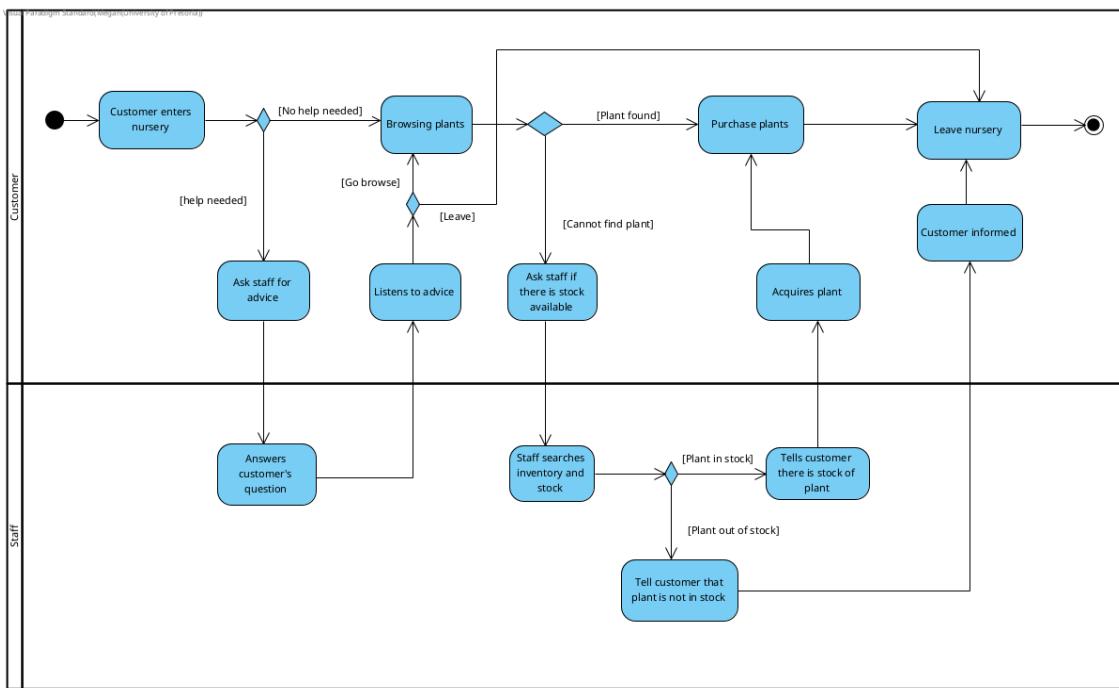
6.1. Class Diagram



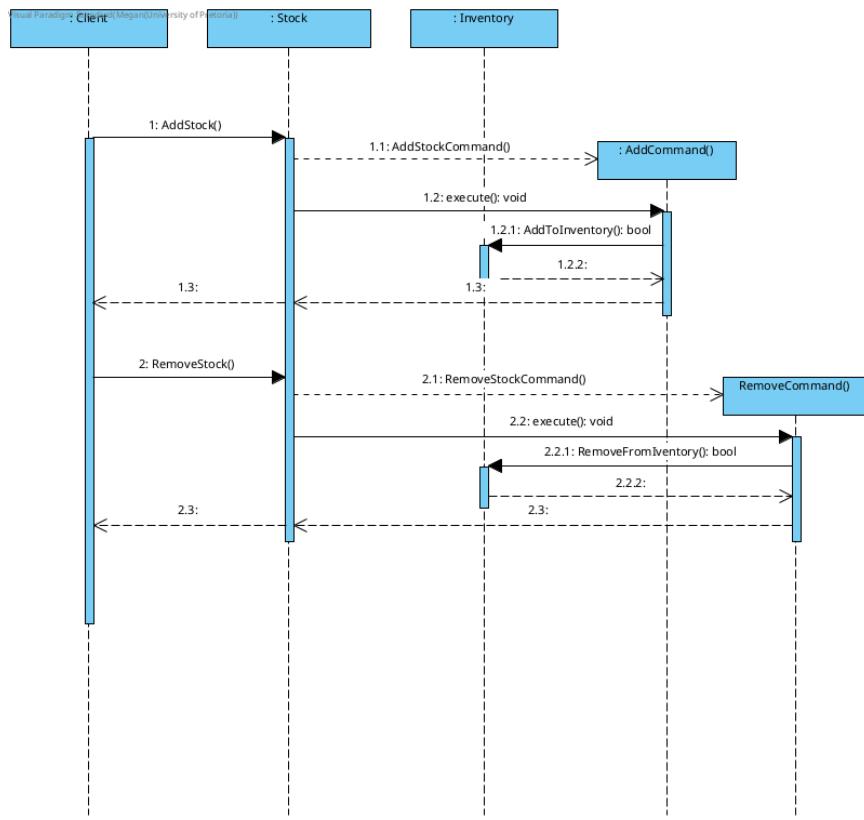
6.2. State Diagram



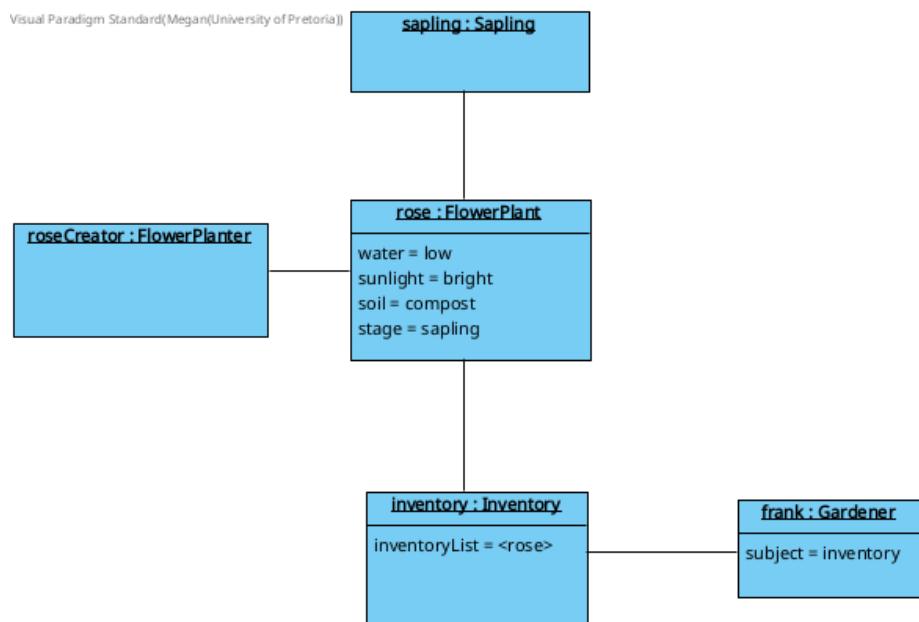
6.3. Activity Diagram



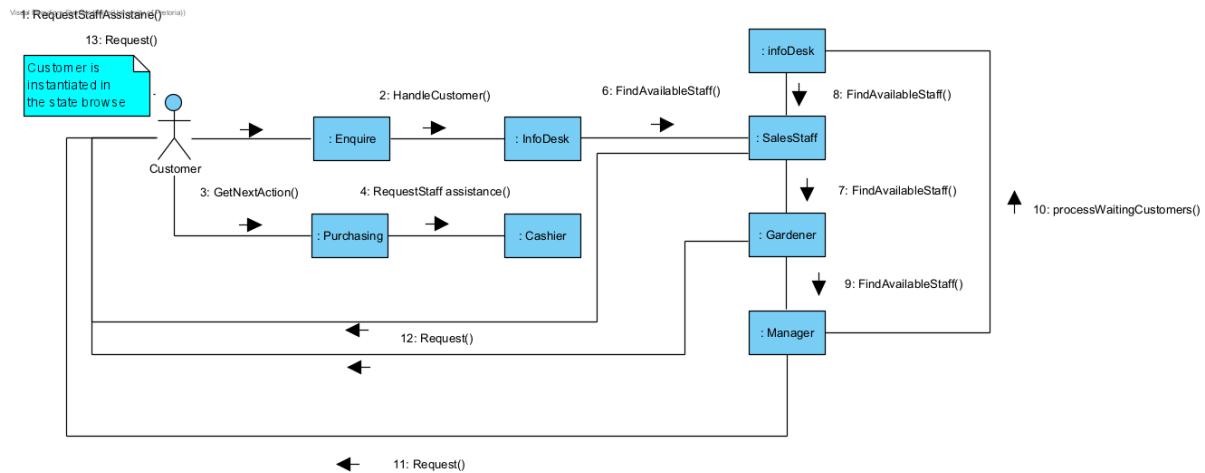
6.4. Sequence Diagram



6.5. Object Diagram



6.6. Communication Diagram



7. References:

Admin, 2025. Different types of Succulents for Beginners [WWW Document]. Stanler Farms. URL

<https://www.stanlerfarms.co.za/different-types-of-succulents-for-beginners/> (accessed 10.30.25).

Indigenous Plant Nursery - Muldersdrift [WWW Document], n.d. . Guest House Accommodation. URL <http://randomharvest.co.za> (accessed 10.30.25).

Petal Faire Nursery in Pretoria Gauteng supplying unusual and exotic plants for the enthusiastic gardener [WWW Document], n.d. URL
<https://petalfaire.co.za/index.php?content=page&id=18&submenu=32> (accessed 10.30.25).

South Africa Online [WWW Document], n.d. . Discover the Beauty and Wonders of South Africa. URL <http://southafrica.co.za> (accessed 10.30.25).

Top 20 Most Common Plants in Gauteng [WWW Document], n.d. . PictureThis. URL
<https://www.picturethisai.com/region/South-Africa-Gauteng.html> (accessed 10.30.25).

Tackling Design Patterns [WWW Document], n.d. URL
<https://www.cs.up.ac.za/cs/lmarshall/TDP/TDP.html> (accessed 10.30.25).

8. Links

GitHub Repository:

https://github.com/Megglez/Chaos_Compilers_COS214_Project_2025

Google Document link:

https://docs.google.com/document/d/1pNxXny8WA27NGEMK5c35jEXHrr4iKFu1k3Qw_p5Tn5Q/edit?usp=sharing