COS 214 FINAL PROJECT

STARTING FIVE

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RESEARCH BRIEF

During our intensive research, we learnt that plants have 4 distinct stages or states: the seed state, sprout state, mature state, and dead state. Research revealed that people have different ways of caring for their plants. Therefore, we had to decide on whether to base our care strategies on the type of plant (flower, tree, succulent), on the specific plant species (rose, tulip, cactus, etc.), or on the current state of the plant. We ended up deciding that the best option is based on the type of plant, since implementation will be easier and more efficient.

We found that temperature control is one of the most important factors in managing a retail nursery environment. Therefore, for our purposes, we assume that light, moderate, and heavy temperature conditions are relative to high temperatures. (Anon., 2016)

Succulents require a lot of sunlight (approximately 6 hours per day) and moderate watering that varies with the season. Overwatering can be fatal to succulents, as they thrive best in well-draining, porous, and sandy soil. (Stamp, 2023)

For trees, water is most crucial, especially for newly planted or transplanted trees (Anon., 2025). All trees need to be watered deeply and regularly. It is important not to overwater the tree since it can lead to root rot. However, deep watering encourages deep root growth, which helps the tree to become more drought resistant. (Anon., 2024-2025). Most trees require full sun/direct sun for at least 6 hours a day (Anon., 2018). For our project, we assume that the trees being cultivated require more than six hours of direct sunlight.

For Flowers, the ideal temperature is between 15.57 degrees Celsius and 23.89 degrees Celsius, with optimal light being bright but indirect. The ideal humidity is between 40% to 60%, making moderate watering conditions most suitable. (Anon., 2024)

Based on the above research, we categorized light, moderate and heavy care as follows:

Light Care: 100ml per watering session; indirect or partial sunlight for 3-4 hours a day. Most suitable for succulents.

Moderate Care: 200-250ml per watering session; bright indirect light for 4-6 hours a day. Most suitable for flowers.

Heavy Care: 300-350ml per watering session; full/direct sunlight (6+ hours a day). Most suitable for trees.

To simulate a real-world nursery management, our software design includes staff roles like those found in an actual greenhouse. Gardeners are responsible for caring for the plants, salesclerks handle customer communication, and the manager oversees inventory management and customer complaints.

FUNCTIONAL REQUIREMENTS

Factory Method- Allows for different factories or departments to make different types of plants.

Composite- Allows for multiple plants to be grouped together. E.g. flower bundles

Prototype- Allows our system to make multiple plants based on other plants.

Decorator- Allows for plants or plant groups to be given modifiers such as plant wrappings and decorative plant pots.

Singleton- Ensures that there is only one inventory at any given moment to avoid inconsistencies.

Command- Allows plant care e.g. Watering plants, giving plants exposure to sunlight, and selling plants to be encapsulated as objects to decouple these functions from invokers.

Builder- Allows for construction of customer receipts and for the construction of plant and flower packages and bundles.

State- The system will have plants in different states, which alters how they are cared for.

Strategy- The system will use different plant care strategies based on the type of plant it is , at different levels of care that each plant needs . E.g. Watering and Sunlight exposure.

Iterator- Allows the system to sort and iterate through plants (by tag) and chats (by messages) between customers and staff.

Mediator- Allows customers to communicate with a staff member to ask for information, request recommendations and to make orders. Also allows for staff-to-staff communication with each other or with customers.

Observer- Notifies changes that occur in greenhouse to the inventory.

Chain of Responsibility- Allows for different staff members/type of staff to handle different requests made by customers.

NON-FUNCTIONAL REQUIREMENTS

Usability: The system provides an intuitive way for staff and customers to complete tasks. E.g. Water Plants, Ordering and Notifications. This ensures that users can interact efficiently with the system, leveraging the Mediator and Command design patterns.

Scalability: The system can support at least 150 users at a time without performance degradation. This ensures that the Greenhouse and Sales subsystems can handle peak loads.

Reliability: The system guarantees near 100% percent uptime and maintains data integrity in the Inventor and Customer service subsystems. This is vital for the Inventory and Sales processes to prevent discrepancies.

Security: The system has a password for staff to ensure that customers do not have access to caring for plants or manipulating them in any way.

SYSTEM FLOW

The system begins by initializing the Greenhouse, which serves as the central hub for plant management and staff coordination. The inventory is attached to the Greenhouse as an observer to track all plant additions and removals. The program also sets up 3 plant factories —Flower, Succulent, and Tree —each responsible for creating its respective plant type using the Factory Method Pattern.

The builder pattern and Command pattern are then initialized to handle various actions in the system, such as selling plants, watering plants, and providing sunlight. These commands are later linked to the appropriate staff members.

Initially, a few sample plants (rose, oak, cactus, tulip) are created and added to the Greenhouse. Staff members are then instantiated:

- Manager- oversees all operations, handles plant care requests, and coordinates between staff.
- Salesclerk- interacts with customers and executes the sell plant command.
- Ground Staff- responsible for watering and sunlight care, using the respective commands.

Each staff member is linked via the chain of responsibility pattern, allowing unhandled requests to be passed along the chain.

The Mediator pattern is used through the Section and HelpDesk classes to manage communication between customers and staff. Two sections, HelpDesk and SalesRoom, are created and assigned to relevant staff members.

USER INTERACTION PHASE

When the system starts, the user chooses whether they are a customer or a staff member.

If customer:

- Provide their name and it is added to both the HelpDesk and SalesRoom sections.
- The customer can view all plants currently in the greenhouse; purchase plants or ask for help via the help desk.
- Each customer action creates and sends a request message (e.g., purchase or help) to the corresponding staff section.
- The Salesclerk or Manager processes the request through the mediator system.

If staff:

- The user must enter a password to access staff functionalities.
- Once authenticated, the staff can care for plants, add plants to the greenhouse, remove plants, view existing plants, and access section history to review Help desk and sales room activity logs.
- All plant additions and removals trigger observer notifications to the Inventory, ensuring consistency.

When the user finishes, the system detaches the Inventory observer, removes all dynamically allocated entities (plants, staff, sections, command, etc.) and exists.

WORK DELEGATION

Brayden Butler:

- Factory Method
- Decorator
- Prototype
- Composite

Mosa Leiee:

- Iterator
- State
- Strategy

Sente Mngomezulu:

- Mediator
- Chain of responsibility

Kundai Ndemera:

- Singleton
- Observer

Lesedi Padi:

- Command
- Builder

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