

Ecosystem Simulation Project

This project simulates an ecosystem with various entities, such as plants, herbivores, carnivores, and omnivores. The simulation allows for the interaction of these entities within a grid, showcasing how they affect each other's survival and growth.

Folder Structure

The workspace contains two folders by default, where:

- `src`: the folder to maintain sources
- `lib`: the folder to maintain dependencies

Class Descriptions

1. Ecosystem

- **Description:** Manages the simulation environment, including the entities and their interactions.
- **Hierarchy:** Base class for managing the overall ecosystem. Contains methods for adding entities and simulating steps.

2. EcosystemEntity (Abstract Class)

- **Description:** Represents a generic entity in the ecosystem, which could be a plant, herbivore, carnivore, or omnivore.

Subclasses	Description	Attributes
Plant	Represents a plant entity that can be eaten by herbivores.	name - The name of the plant energy: The energy level of the plant. x, y: Coordinates in the simulation grid.
Herbivore	Represents a herbivore that consumes plants.	Inherits from EcosystemEntity. Additional attributes for speed and behavior.
Carnivore	Represents a carnivore that consumes herbivores.	Inherits from EcosystemEntity. Additional attributes for hunting behavior.
Omnivore	Represents an omnivore that can consume both plants and herbivores.	Inherits from EcosystemEntity. Additional attributes for varied diet behavior.

Method Explanations

Ecosystem

- `addEntity(EcosystemEntity entity)`: Adds an entity (plant, herbivore, carnivore, or omnivore) to the ecosystem.
- `simulateStep()`: Advances the simulation by one time step, allowing entities to act and interact.
- `displayState()`: Displays the current state of all entities in the ecosystem.

EcosystemEntity

- `isAlive()`: Returns whether the entity is still alive based on its energy level.
- `act(Ecosystem ecosystem)`: Abstract method to be implemented by subclasses, defining how the entity behaves during a simulation step.

Plant

- `act(Ecosystem ecosystem)`: Defines behavior for plants, such as growing or reproducing.

Herbivore

- `act(Ecosystem ecosystem)`: Implements behavior for herbivores, such as eating plants and moving.

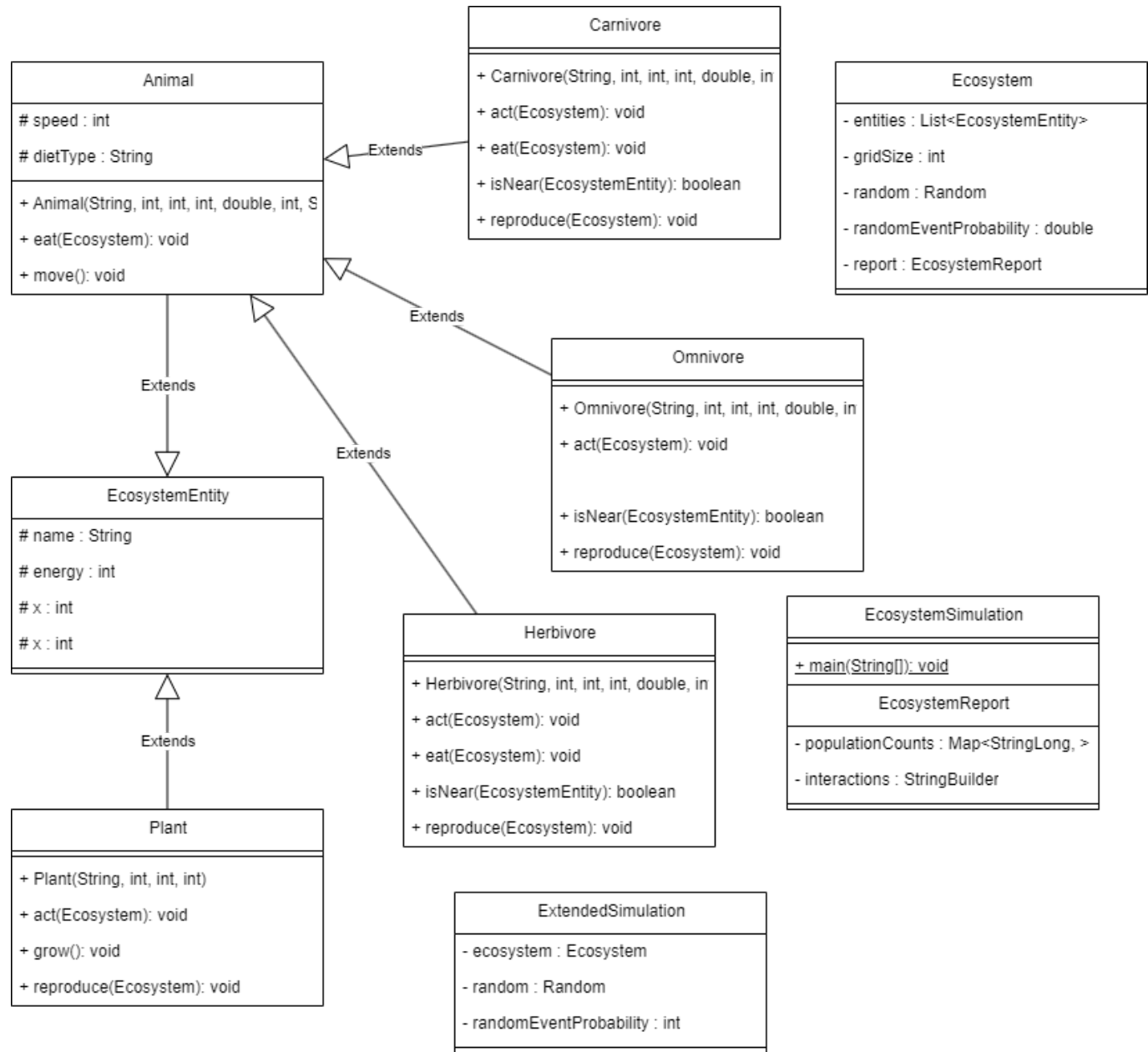
Carnivore

- `act(Ecosystem ecosystem)`: Implements behavior for carnivores, such as hunting herbivores.

Omnivore

- `act(Ecosystem ecosystem)`: Implements behavior for omnivores, allowing them to consume both plants and herbivores.

UML Diagram



Usage Scenarios

Program menu

```
=====
Ecosystem Simulation
=====
1. Add a Plant - Add a new plant entity to the ecosystem.
2. Add a Herbivore - Add a new herbivore entity that eats plants.
3. Add a Carnivore - Add a new carnivore entity that eats herbivores.
4. Add an Omnivore - Add a new omnivore entity that eats both plants and herbivores.
5. Simulate Step - Advance the simulation by one time step, allowing entities to act.
6. Display Ecosystem State - Show the current state of all entities in the ecosystem.
7. Generate Final Report - Display the final report of the ecosystem.
8. Run Extended Simulation - Run a series of simulation steps automatically.
9. Exit - Exit the simulation program.
=====
Choose an option (1-9): S
```

Program simulation steps

```

--- Simulation Step 1 ---
stejar at (1, 5) is acting... Grows and energy increases by 10.
urs at (1, 7) is acting... Moves to (1, 7).
lup at (9, 6) is acting... Moves to (9, 6).

--- Ecosystem Grid ---
. . . . . P . H . .
. . . . . P . H . .
. . . . . . . . . .
. . . . . . . . . .
. . . . . . . . . .
. . . . . . . . . .
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. . . . . . C . . .

--- Simulation Step 2 ---
stejar at (1, 5) is acting... Grows and energy increases by 10.
Plant "stejar Seedling" added at position (1, 6) with energy 20.
urs at (1, 6) is acting... Moves to (1, 6).
urs at (1, 6) eats stejar Seedling!
lup at (7, 9) is acting... Moves to (7, 9).

--- Random Event: New Species Appears! ---
Herbivore "New Herbivore" added at position (3, 8) with energy 80.
A new herbivore species has appeared at (3, 8).

--- Ecosystem Grid ---
. . . . . P H . . .
. . . . . P H . . .
. . . . . . . . . .
. . . . . . . H . .
. . . . . . . . . .
. . . . . . . . . .
. . . . . . . . . .
. . . . . . . . C .
. . . . . . . . . .
. . . . . . . . . .

```

Program observed interactions

```
--- Final Ecosystem Report ---
Plant population: 3
Herbivore population: 7
Carnivore population: 3

--- Observed Interactions ---
stejar added to the ecosystem.
urs added to the ecosystem.
lup added to the ecosystem.
stejar Seedling added to the ecosystem.
urs ate stejar Seedling at (1, 6).
stejar Seedling removed from the ecosystem.
New Herbivore added to the ecosystem.
New Herbivore ate stejar at (1, 6).
stejar removed from the ecosystem.
New Herbivore Offspring added to the ecosystem.
```

Difficulties Encountered

Difficulty	Solution
Managing entity interactions during simulation steps.	Implemented a clear method for handling interactions and ensuring that entities acted in a defined order.
Ensuring proper energy management for entities.	Developed a consistent method for updating energy levels based on consumption and actions taken.