

Ecosystem Simulation Project

A Java program simulating the interactions of plants, herbivores, carnivores, and omnivores in an ecosystem.

Folder Structure

- **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, energy, x, y
Herbivore	Represents a herbivore that consumes plants.	speed, behavior
Carnivore	Represents a carnivore that consumes herbivores.	hunting behavior
Omnivore	Represents an omnivore that can consume both plants and herbivores.	varied diet behavior

Method Explanations

Ecosystem

- `addEntity(EcosystemEntity entity)` : Adds an entity to the ecosystem.
- `simulateStep()` : Advances the simulation by one time step.
- `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 defining entity behavior.

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Plant

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

Herbivore

- `act(Ecosystem ecosystem)` : Implements behavior for herbivores, such as seeking and consuming plants, and moving within the ecosystem.

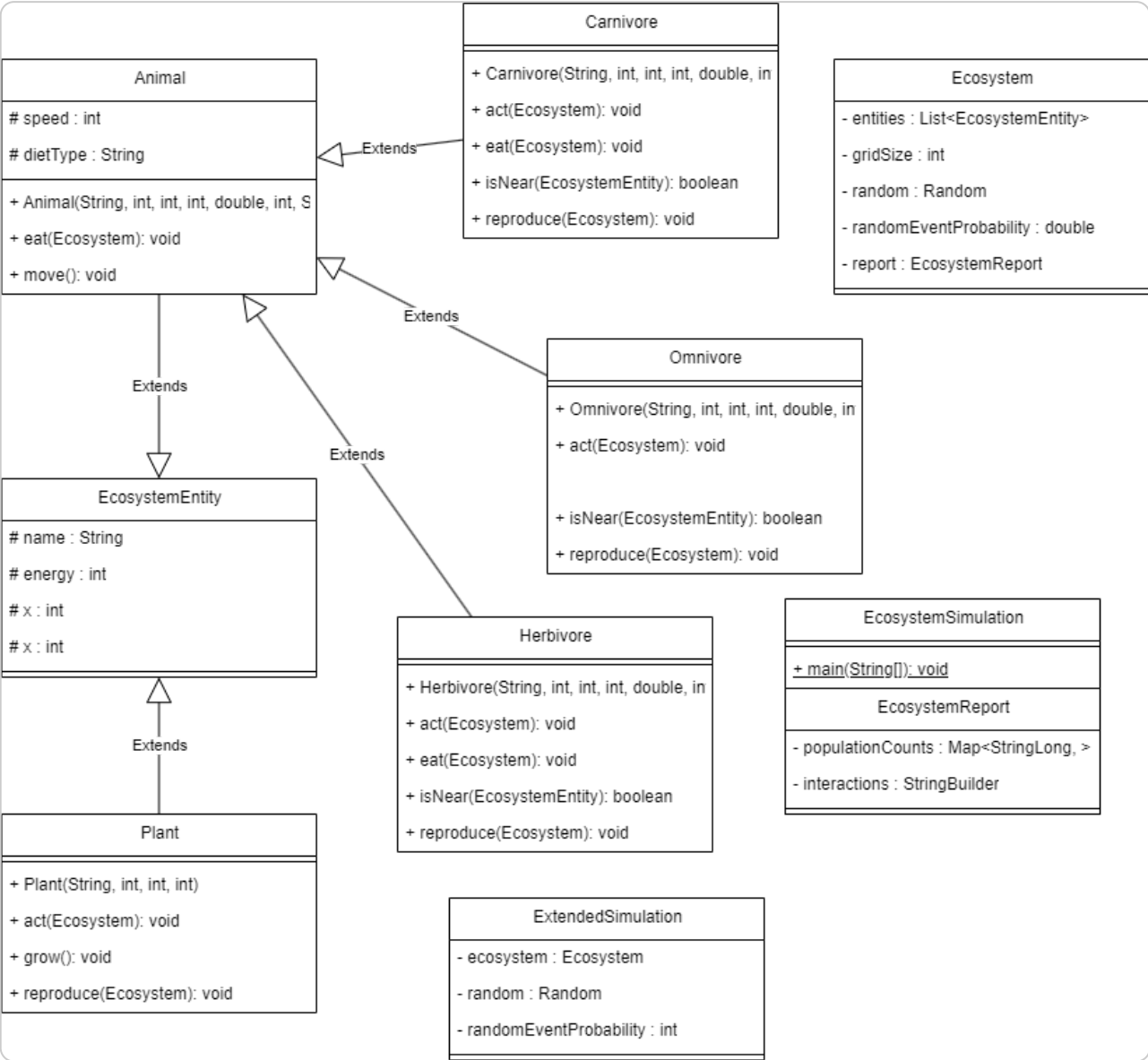
Carnivore

- `act(Ecosystem ecosystem)` : Defines behavior for carnivores, including hunting herbivores and managing energy consumption during movement and hunting.

Omnivore

- `act(Ecosystem ecosystem)` : Implements behavior for omnivores, allowing them to consume both plants and herbivores, with logic to prioritize based on proximity or energy needs.

UML Diagram



Usage Scenarios

```
=====
      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
```

```
--- 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 . .
. . . . .
. . . . .
. . . . .
. . . . .
. . . . .
. . . . .
. . . . .
. . . . .
. . . . . 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 . . .
. . . . .
. . . . . H .
. . . . .
. . . . .
. . . . .
. . . . . C
. . . . .
. . . . .
```

```
--- 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.