Predator/Prey Empire Simulation

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1 Simulation Overview

Our simulation models the dynamics and interactions of various historical empires and civilians within a bounded environment. The empires represented are the British, Spanish, Romans, Persians, and Amazonians, each with distinct behaviors and characteristics. The simulation will run until there is only one empire left standing, and only then will terminate (and play the winning song). Different empires have distinct behaviors, including movement, recruitment, and combat interactions. The weather system adds further complexity by influencing each empires actions.

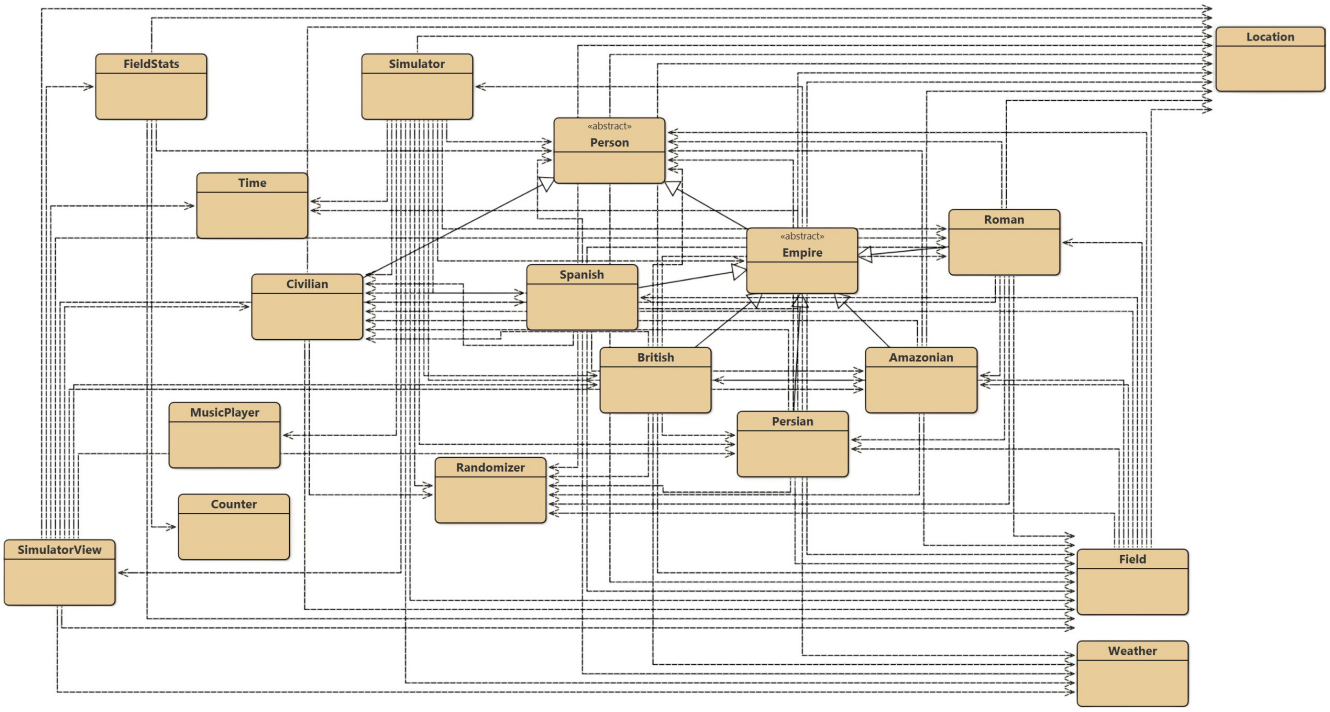

Figure 1: Class Diagram for Predator/Prey Empire Simulation

2 The Empires Of The Simulation

All Empires in our simulation inherit from the abstract `Empire` class. That gives them access to essential information like the current time and weather. This class ensures the subclasses will have required methods like `conquer()`, `reproduce()` and `recruit()`. Also, the `Empire` class itself inherits from the `Person` class methods such as `isAlive()` and `getLocation()`, which are used a lot throughout the simulation code, and in the `Civilian` class as well.

- **The British Empire:** Predators. Their enemies are the Persians and the Romans. British soldiers are boosted in rainy weather (see challenge tasks section 3.2). Inactive during night time (GMT+0) and tea time (3 PM - 5 PM).
- **The Spanish Empire:** Predators. Their enemies are the Amazonians and the Romans. Spanish soldiers are boosted in sunny weather (see challenge tasks section 3.2). Inactive during the night time (GMT+1), and siesta time (2 PM - 4 PM).
- **The Roman Empire:** Both predators and preys. Their enemies are the Persians and the Amazonians, and they are killed by the Spanish and the British. Because in ancient Rome, only males were allowed to fight, all Roman soldiers are male, and they reproduce randomly. They can also only recruit male civilians. Inactive during night time (GMT+1) and Roman bath time (11 AM - 1 PM).

- **The Amazonian Empire:** Prey. They are killed by the Spanish and the Romans. Because the Amazonians are a strong nation of female warriors, all Amazonian soldiers are female, and they reproduce randomly. They can also only recruit female civilians. Amazonians soldiers are boosted in foggy weather (see challenge tasks section 3.2). Only not active when all other empires are inactive as well (23 PM - 6 AM).
- **The Persian Empire:** Prey. They are killed by the British and the Romans. The Persians have no special Characteristics. Inactive during night time (GMT+4).

3 Challenge Tasks

3.1 Civilians

Civilians are a unique entity that can be recruited by any empire. In the code, they are created with the `Civilian` class which is a subclass of the superclass `Person`. When the simulation starts, they are populated in the field like the rest of the soldiers are. If there are no civilians left in the simulation (from being recruited / death), they will eventually respawn randomly to maintain balance. The possible actions of the civilians are: move and, if they meet the conditions, reproduce.

3.2 Weather System

Weather conditions dynamically affect species behavior:

- **Sunny:** Because Spain is very sunny, Spanish soldiers can kill enemy's twice as far (a radius of 2 squares).
- **Rainy:** Since the UK is extremely rainy, the British are used to it, and so they can fight better in the rain. When the weather is rainy, British soldiers move twice in the same step, allowing the to reproduce then kill, for example.
- **Foggy:** The home of the Amazonian's, Themiscyra, is covered in a mysterious mist the shields them from the outside world. In foggy weather, the Amazonia's disappear from the map as long the the fog holds.
- **Snowy:** Because fighting in the snow is significantly harder, during snowy weather all soldiers have a 50 chance of not moving (skipping their turn).
- **Moderate:** The default weather. No special changes to any empire.

3.3 Music Implementation

We have implemented a dynamic music system that changes based on the dominance of different empires. Each empire has its own unique background music that plays when it is "winning" (defined as having the most soldiers on the field at a given time).
The system is managed by an instance of the `MusicPlayer`, which ensures the transition between the different tracks. When the leading empire changes, the current track stops playing and the new leader's track starts playing. This is done with the call to the method `updateMusic()` in each `simulateOneStep()` call.
Finally, when only one empire remains, the system will automatically transition to the "winning" music, signifying the victory of that empire.

4 Known Bugs and Issues

- In rare cases, one empire dominates the field during the entirety of the simulation. This is due to the randomality of the start of the simulation.
- As our simulation runs until one empire is left, the process of actually terminating the game can be a little bit long. When two empires are remaining, they either don't interact with each other so the simulation waits for one of them to die out of age, either the time and weathers make the last two empires enter a cycle of almost dying then repopulating back (when the other empire is not moving, for example).
- When the weather is set to `FOGGY`, the Amazonians "disappear" but essentially the only change is their colour (same as the background): the rest of the empires can still interact with them while they are in their "hidden" state.

Despite these minor issues, the simulation runs smoothly and demonstrates the intended interactions between species and environmental factors.