COS 214 Project - 04/10/22

War Engine

Basic war engine to model a war.

```
while (war in progress) {
    // Update values for theatres in the war
    country1.makeDecisions();
    country2.makeDecisions();

    battle();

    // After each turn give user a summary of battles which occurred
    displayResults();
    turn++;
}

makeDecisions() {
    // Income Phase
    displayIncomeAndResources();

    // Production Phase
    // Transport units to theatres
    buyUnits();

    // Battle Phase
    for (each theatre) {
        pickStrategy();
    }
}

battle() {
    // Compare strategies for theatres and apply modifiers
    // Kill troops, take over regions, and update state of war
}
```

Components of War

5.2.1 - Theatres

Regions where the war between countries or alliances will take place. The region states are binary. Either a country or alliance has control of a region or they don't. If a country or alliance have captured all the regions then the war ends. At start of game/simulation majority of theatres will be uncontrolled. Each country or alliance of countries will have a *home* region.

5.2.2 - Transportation

Countries will be able to transport units, troops, services from their base/home region to specific regions in which warfare has to take place in. Transport can also occur between regions. Transport can be sabotaged or attacked while in progress. This can be modelled by reducing the amount of units, troops or services in transport by a specific percentage.

5.2.3 - Entities

Model different types of units for land, sea, and air. That is, light, medium and heavy. Units can be sent to various regions or battle fields to partake in the war. Entities can have different states. For example, in transport, stationed, fighting, injured and dead. Countries or groups of countries can have and army of battalions and each battalion is made up of units and troops.

Specification also mentions medics, refugees, citizens and there different states like unlisted, fighting, or returned, etc. It has not really been discussed how this can be modelled.

5.2.4 - Phases of War

- War Phases Implement some sort of escalation strategy. War state can be escalated as the war progresses. Early, middle, and late stages of war. Can adjust economies of countries involved accordingly. Can also implement more specific states such as a seize fire between countries.
- Turn Phases Income, production and battle phase, cycle through these phases every round. Income phase handles the income and resources after a turn has taken place and before the next turn starts. Production phase handles the acquisition of units and troops to send to various regions or battle fields. Lastly, Battle phase handles the actual battles taking place between countries in a region. The Battle phase has multiple strategies which a country can pick from. For example, plan, attack, and counter.

5.2.5 - Changes to War Engine

Countries will be able to join or leave alliances as the war progresses. Countries will also be change sides or retreat from the war completely. Countries or group of countries will be able build and develop a small tech tree of sorts. This will enable countries to spend a portion of their income in order to research various skills. These skills will add additional strength to countries as war progresses.

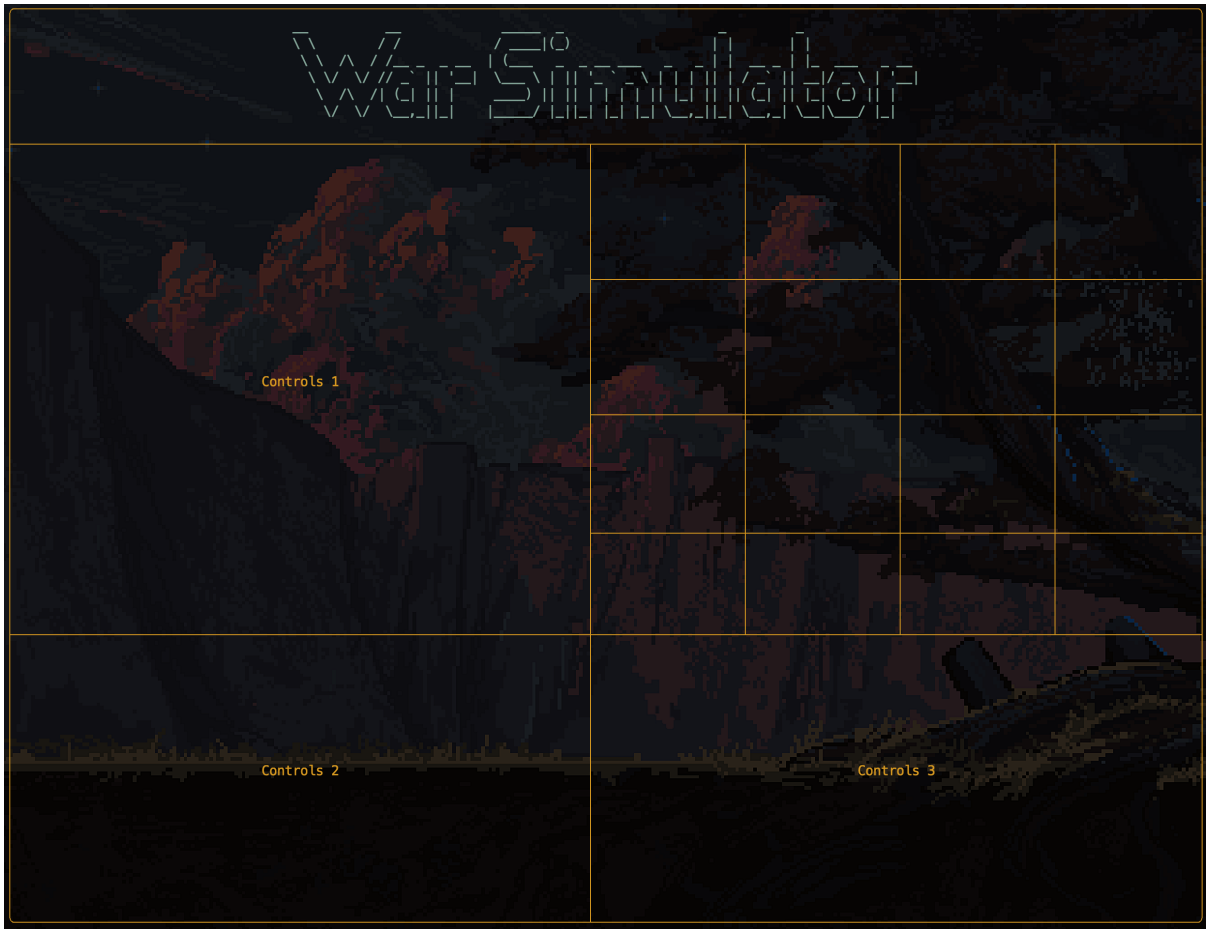
5.3 - War Simulations

Current plan is to model the war as a turned base *game*. Snapshots can be taken of the various turns in a war. If needed snapshots can also be taken of the phases inside of every turn. This will allow us to *write* or play simulations. Theses snapshots can be parsed as structured JSON data to be stored as full simulations and individual snapshots can used by the TUI to easily represent the data to the user.

GUI/TUI

Want to implement a user interface in order showcase and interact with war simulations more intuitively. Every war simulation will have a vast amount of various aspects which will easily

get cluttered if console output alone is used. Want to keep it simple, but as usable as possible. Need to be able to easily navigate through and adjust war simulations as necessary in design mode. For example, skip between rounds and adjust country armies.



Potential Patterns

- `Template Method` - Units can have template methods attack/defend. Each unit implements their own primitive operations for attack/defend. (5.2.3)
- `Abstract Factory` - Creation of of the different battle units. Three categories. Light, medium, heavy. Will correspond to each of the three different units of each type. e.g. Land unit factory method for the Heavy factory will generate a Tank. (5.2.3)
- `Factory` - Creation of different theatres regions. (5.2.1)
- `Prototype` - Make clones of entities, regions, etc.
- `Strategy` - Each country can make use of a list of different strategies to use in battle. These are strategies like, Plan, Attack, Counter. (5.2.4)
- `State` - Can be used to model the different battle phases. Can also be used to model the states of the units and troops. (5.2.3)(5.2.4)
- `Composite` - Model the armies and battalions of each country. For example, Armies and battalions are composites where troops and units are leafs. (5.2.3) Model alliances between countries. (5.2.5)
- `Memento` - Store snapshots for the the war simulations. (5.3)

- `Observer` - Can probably be used somewhere else. However, first thing that came to mind was to use it with the GUI. The user interface has to notify the war engine that changes was made by the user.
- `Singleton` - There should only ever be one war engine in existence.